Revised Report

An assessment of the extent of food processing in various food sub-sectors

Submitted to Ministry of Agriculture

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Preface

Many of the farm products especially animal based, horticultural and also some of the traditional food crop products are amenable for processing into food and other end products. Promoting food processing could strengthen the link between agriculture and industry and help in generating farm income and employment as also in reducing wastage of agricultural products. A strong database is required for pursuing a policy towards this end. As currently the data available is inadequate and is based mostly on insights, this study is an attempt to initiate the process of estimating the extent of processing agricultural food products in India based on methods that are deliberated, transparent and available for further debate and development.

The estimates are anchored on secondary data available from official data bases enjoying some degree of confidence and continuity and the methodology was developed through a process of consultation and reviews. Along the way, several constraints relating to data, methodology and specification were encountered and addressed in ways that were agreed to be reasonably acceptable under the circumstance. The presence of representatives from different agencies including the Ministry of Agriculture (MOA), Ministry of Food Processing Industries (MOFPI), National Sample Survey Office (NSSO) and Central Statistical Organization (CSO) at the consultations made this possible. Comments and suggestions on a draft report recorded in the email dated August 14, 2013 and also a ready response of Mr. Satya Narain Singh, DDG (CPD) and CPIO, NSSO helped in revising the draft.

Special acknowledgement has to be made to the pioneering and insightful contributions of Shri Rakesh Kacker, former Secretary of MOFPI in building up the methodology followed. His interest in the study was a driving force that was kept up by the current Secretary Mr. Siraj Hussain. Both MOFPI and MOA supported us in all ways in accessing data, eliciting clarifications and availing other required support for the conduct of this study. Shri Bivas Chaudhuri of CSO has been always ready to clear our doubts and a discussion with Shri Sudipto Bhattacharya at CSO-IS wing in Kolkata was extremely useful. I thank Shri B S. Bhandari of

MOA and Shri Gajendra Bhujabal of MOFPI for their constant cooperation. Suggestions and comments received from the MOFPI on the draft report added value to the study. My special thanks go to Dr. M. J. Bhende of ISEC for going through the report carefully. I also thank Prof. Parmod Kumar of ISEC for his timely coordination in the peer review process.

Officials at the Institute of Economic Growth (IEG) also appreciated the urgency of completing this study and I thank our Finance Officer Shri D. D. Kandpal for responding with quick support in the process. Apart from Mr. Sunil Singh of AERU, IEG I would like to sincerely thank a number of other junior researchers who took time out from FASAL project at various points of time to help me in this study conducted under the AER scheme with their expertise. Ms. Supriya Sharma now in the Indian Statistical Service, Mr. Rajeshwor and Mr. Ruchin Verma contributed immensely to this study in analysis, literature review and data collection. In particular I thank Ms. Roopal Jyoti Singh for devoting enough time since April 2013 in reading, extracting and analyzing the NSSO and ASI data with care and diligence. Mr. Arhit Ghosh and Ms. Inderpreet Walia students of Symbiosis School of Economics, Pune who worked as summer interns in our department took keen interest in our work on food processing sector and contributed with literature survey and data collection in synergy with their own curricular requirements.

Finally, Prof. Manoj Panda, the Director of Institute of Economic Growth (IEG), Prof. N. Chandrasekhara Rao Head, AERU, IEG and the Economic and Statistical Advisors (ESA) in the MOA, Mr. R. Vishwanathan (now retired) and Mr. B. Gangaiah (current) are acknowledged for keenly encouraging this work from the background with all possible support. Suggestion that later came from Mr. Bhujabal of MOFPI and Ms. Sangeeta Verma of MOA helped us to incorporate further refinement and revision in the report.

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Highlights

1. Modern Food processing (FP) draws on scientific methods and is open to critical reviews and regulatory impositions. It helps to reduce negative changes in food over time, please the consumer with flavor, taste and colour, cater to cultural values, empower women and provide choice, information and convenience to the health conscious consumers. It can be a potent tool to reduce food wastage.

2. In India the growth of a FP sector can be a symbol of a strong linkage between industry and agriculture, so that investment in the industry may result in improved production and returns from agriculture. More employment is likely to be generated in agriculture and industry. By reducing food wastage FP can help to conserve resources.

Empirical Results

3. Estimates of the extent of FP can be a measure of the linkage between agriculture and industry. They are useful for monitoring the performance of the sector and devising policy. While the potentials of the sector are discussed widely, little effort is made to generate credible statistics world over. Casually cited estimates appearing in literature are not backed by sources or rigorous methodology.

4. We estimate the extent of FP as a manufacturing activity using official data and based on a transparent methodology involving assumptions only where required to overcome data constraints.

5. The Extent of processing of agricultural products (EPA) of the combined sector (Organised and Unorganised) for the sub-sectors exhaustive of all items are estimated for 2005-06 under assumptions made about prices. They are 1.05% for fruits, 1.23% for vegetables, 5.4% for milled pulses, 17.7% for

milled coarse cereals, 8.5% for spices, 8.3% for meat, 1.6% for milled rice, 2.05% for milled wheat and 14.1% for fish.

6. The EPA for average of the years 2003-04 to 2009-10 in the organized sector considering only select major items is high for Soyabean (30%), Coarse Cereals (12%), Fish (11%) and Fresh Milk (11%). The EPA has gone up between 2005-06 and 2010-11 for only a few products such as maize, is unstable for oils and declined for milk. The organized sector dominates in FP despite the large number of unregistered food processors.

7. The estimated EPA differs from those cited in literature (KPMG et al.) and those estimated using FAO's Food Balance Sheet. In particular our EPA for Milk is considerably less than these alternative estimates though closer to NDDB's estimate (8% - 25%).

8. The estimates of EPA for Milled Cereals are low barring Maize probably due to its multiple uses as well as government intervention and the importance of self-consumption by farmers in Rice and Wheat markets. Working out the extent of basic processing (milling) for 2005-06, only 24% of Paddy and 17% of Raw Wheat are found to be processed and these estimates declined over time. The intensification of Wheat procurement and increasing incidence of public purchase of Paddy from farmers for custom milling may be responsible for the phenomena in which milling is done as a service.

9. The average extent of food processing covering all items in 2010-11 is 5.42% if a simple average is used and 6.76% if a value weighted average is used.

Contents

1. Introduction

The wide range of topography, soil quality and climatic conditions that describes India makes her agriculture advantageous for producing a large number of crop and non-crop products. The possibility of processing some of these products to value added items signifies sizeable potential for the development of the agricultural sector in India as also for generating employment within and outside agriculture and in rural India in particular. Processing of perishable products can also play an important role in reducing wastage of food that in turn translates to saving of valuable water and soil resources and reducing carbon emissions. Adequate focus on the agro-processing sector to strengthen the links between agriculture and industry will be of critical importance in coming times.

Food technology, managerial practices and scientific understanding of nutrition having witnessed giant progress in the last few decades, the most familiar and domesticated human activity today presents a vast emerging area for commercial exploitation and economic research. Yet, as a sector in the economy, food processing is less studied than many others till date. Food processing can potentially be a major generator of employment and income in many developing countries if more investment flows into the sector[1].

Development of the agro-processing sector as industry in India is an unfinished task till now. Although the sector is operated almost entirely by a motley of private firms, small, medium and large, at this nascent stage, the government has a critical role ins setting the stage for its development. To promote the sector, there is now a separate Ministry of Food Processing Industries (MOFPI) at the Centre. However, in India's federal set up, it is important to maintain synergy between the agricultural Plans of the states and the development of food processing

[1] Agricultural and fish products need to be processed so that they may be stored, transported conveniently over distances, and presented in forms appealing to consumers. Food processing can also help to extend the markets in which these products can be sold, enable access to markets not otherwise accessible, and permit sales at higher prices and in larger quantities.

sector as a national endeavour. To invite state participation and to decentralize the implementation of central schemes a National Mission on Food Processing (NMFP) is due for implementation. Food processing industries in India have been accorded the status of a sunrise sector in the recent period.

In order to effectively monitor the impact of existing schemes and to formulate appropriate policies, it is vital to maintain reliable data relating to production and other aspects of the sector and to assess the performance and usefulness of the sector. Unfortunately no systematic and scientific data pertaining to food processing activities and their demand for agricultural products based on 'harmonised concepts, definitions and classifications' is apparently available (MOFPI, 2012). The data required to support the government policy-making process is sourced from different functional departments, business associations, research institutions and NGOs. The data produced by these sources is not mutually comparable for lack of uniformity of methodology and product classification. In fact it is understood that the Industry Associations and expert groups often rely on insights, subjective projections, and insider information. The lack of objectiveness of these methods makes it difficult to validate the data and present them in public domain.

1.2. Agro-processing as a way to develop Indian Agriculture

Agriculture remains the key source of livelihood in India supporting large sections of poor people even while much higher incomes are being generated in sectors other than agriculture. The commitment to food security of the large population as perceived at the time, bound Indian agriculture to a traditional pattern of producing mostly cereals to be marketed in a regulated fashion via a string of intermediaries to reach consumer households for further action. Horticulture and animal based farming played either an insignificant or a supplementary role because their products were highly perishable. The linkage in the market was mostly between the farm and the consumer and the presence of industry in the chain was weak.

In the aftermath of the green revolution and since 1990 several changes occurred in India to transform the economy and to demand substantial rethinking on the developmental strategy for agriculture. India attained food sufficiency at the national level[2] and even started generating surplus for exports while the dynamics of globalization in the wake of the formation of the WTO stimulated some reconsideration of the inward looking policy of India related to agriculture and its product use. Production needed to fall in line with comparative advantages even though food security should continue as a minimal requirement.

At the same time as India grew in affluence, food habits changed mostly away from cereals and towards fruits, vegetables and dairy products, a tendency marked in other similarly placed countries too. These emerging food products require suitable preservation and processing and appropriate marketing channels (Ghosh, 2013_a). Urbanization, dissemination of scientific knowledge, a rising middle class with changes in its sociology and gender roles created space for food that required less processing at the household level even while its nutritional value is conserved. Processing is fast becoming an indispensable means of value addition to farm produced food and a link between the plough and the plate.

Culturally, as in most countries including in the west, food items were mostly purchased as raw farm products by consumers who processed or cooked them to edible forms as necessary within their domestic precincts. However, agro-processing has also been common and a major source of livelihood but often such processing is primary in nature and is most frequently conducted in informal enterprises with low levels of technology. If steered appropriately, such enterprises can have a strategic developmental role in countries like India where farming and fishing are major productive activities (Abbot, 1994). They can also become a crucial linkage between the large unorganized agriculture on the one hand and the formal industrial sector on the other. Food processing is where business meets agriculture (Behera, 2004).

[2] This does not rule out food insecurity at the household level which could still be caused by low purchasing power, weak distribution systems, poor infrastructure in an agro-climatically diverse country and social limitations like gender relation (Ghosh and Khasnobis, 2008)

Diversification and commercialization at the upstream end of the value chain, i.e., at the farm level and the delivery of the product in desired form to the downstream users present a multitude of transitions through which an organized food processing sector can change the way of life and economic functioning in India. It is also foreseen that the growth of the sector will reduce the wastage of farm products[3] and enhance the productivity of agriculture by drawing private investment and advanced technology.

The linkage between agriculture and food processing industries is profound and deep with several institutions like contracts, retail organizations, farmer associations, promotional strategies for small and medium enterprises, machine manufacturers and other agencies like small traders, transporters and women's collectives having some roles. An improvement in the total factor productivity of one sector is likely to spill over into the other highlighting the synergy between the two.

1.3. Indian Agriculture: Diversification, commercialization and Value addition

Agriculture traditionally was a subsistence oriented activity in India undertaken in small farms. This dominant economic activity in the country was also unfortunately associated with low productivity and poverty. The green revolution based on advanced seed inputs dealt a frontal assault on this status improving production substantially. Although India's food insecurity was alleviated by the technological transformation, the technology's limited purview in terms of crops and the regions was criticised as a serious weakness. Not only did the revolution generate a cereal centric orientation of Indian agriculture, its regional specificity left much of India especially the rain-fed tracts outside its reach. With the green revolution reaching saturation, even the beneficiary regions became encumbered with ecological difficulties.

3 An estimated 30 % of the fruits and vegetables go waste in India due to improper methods of processing, packaging and storing (Murthy, 2010) but other studies have found the incidence less.

The focus of India's agricultural policy shifted towards carrying technological progress to lagging regions, saving and management of water and diversification towards non-cereal crops in recent decades. Meanwhile liberalization and globalization created opportunities for several other products like horticulture and animal based products and both to suit the perishable character of these products and to create income earning possibilities for farmer, keeping with the spirit of reforms, a need was felt to evolve appropriate marketing systems by relaxing the existing regulations.

Table 1.1: Area and value shares (%) of different crops in India

Crops	TE1982-1983		TE1992-1993		TE2002-2003		TE2007-2008	
	area	VOP	area	VOP	area	VOP	area	VOP
Rice	22.6	23.4	22.7	22.6	23.3	20.9	22.1	17.5
Wheat	13.1	13.2	13.2	12.6	14.5	13.9	14.3	12.5
Maize	3.4	2.2	3.1	1.8	3.6	1.9	4.0	2.1
Total cereals	57.6	45.5	53.8	41.4	53.0	39.7	50.7	35.2
Pulses	14.3	7.2	12.9	6.9	11.9	6.0	11.9	5.8
Oilseeds	9.4	9.9	13.9	14.1	13.7	10.3	14.9	11.1
Fibers	5.2	4.5	4.7	4.8	5.2	3.9	5.2	5.3
Beverages	0.3	1.3	0.4	1.3	0.5	1.6	0.5	1.3
Spices	1.0	2.3	1.1	3.0	1.2	4.0	1.1	4.0
Fruits	1.3	8.8	1.6	9.0	2.1	12.7	2.7	13.7
Vegetables	2.0	11.0	2.5	10.5	3.3	12.7	3.8	13.3
Sugarcane	1.8	8.3	2.0	7.8	2.3	7.8	2.5	9.0

Source: Reproduced from Birthal et al. 2013, VOP=value of products, TE= triennium ending.

Agro-processing often goes simultaneously with agricultural diversification as perishable products like meat, milk, poultry, fruits and vegetables, often termed as high value products (HVP), are in greater demand of processing. However it is agreed that such diversification is not a simple affair unless the infrastructure, facilities and marketing systems are suitable modulated. Although in an agriculture largely operated by small farmers the practicability of reformed marketing channels is persistently questioned[4], diversification is observed to be already underway (Table 1.1) though more marked in the value share than area cultivated.

[4] It is deemed to be more risky for resource poor small farmers to switch from foodgrains to commercial crops some of which are easily spoilt. Large corporate buyers too may be likely to prefer larger sellers to reduce their transaction costs.

The area shares of rice and wheat have largely been stationary though not stable. The share in area and value of total cereals and pulses declined while fruits and vegetables gained. Oilseeds gained share in area while fibres and spices made small gains. Small farmers are also found to show greater preference than other classes to vegetables (figure 1.1) besides rice and wheat and their access to livestock is fairly high (figure 1.2) considering that their numerical strength is over 80%. Direct marketing, contract farming and retail chains are already emerging and also including the smaller farmers in the wake of the recent round of reforms (Ghosh, 2013$_a$).

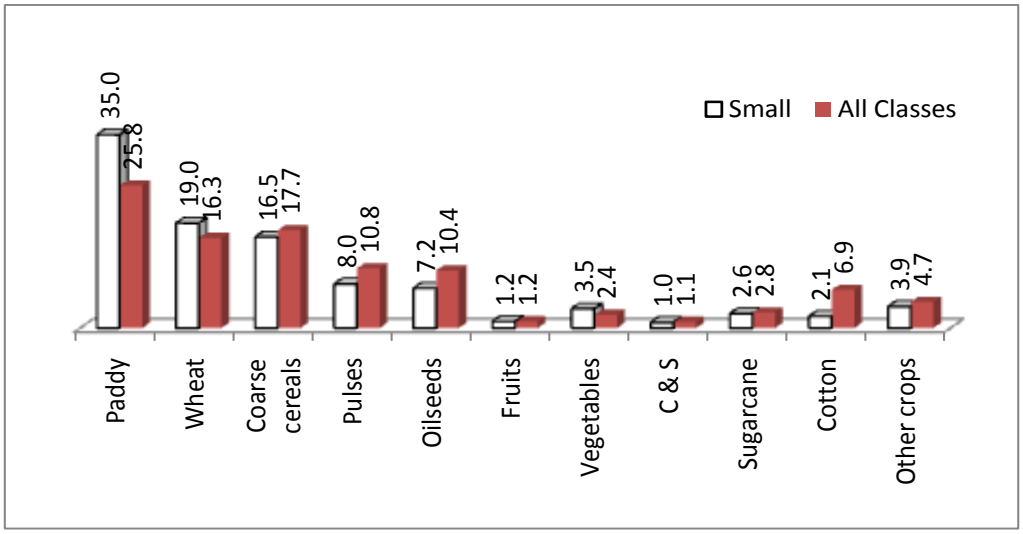


Figure 1.1: Cropping pattern in 2003 of Farm classes as crop share in total cropped area (%). Source: Reproduced from Birthal et al. 2013.

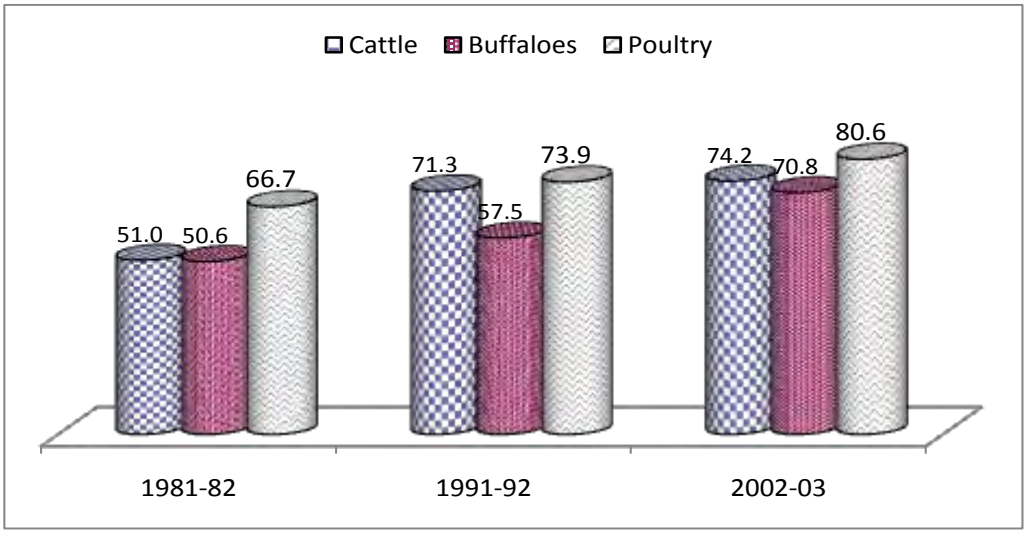


Figure 1.2: Share of small farmers in livestock Population (%)
Source: Reproduced from Birthal et al. 2013.

Promoting agro-processing is seen as a way to enhance farm incomes in India as it raises the demand for agricultural products for further value addition. The amendment of the Agricultural Produce Marketing Act that rigidly guided agricultural marketing in India, encouragement of food parks, export processing and cold chains and the raising of the cap on FDI on retail trade are possible measures tried in this direction. However in practice such policies are not easy to implements due to problems of inadequate investor interest, macro-economic limitations, political concerns over unemployment of conventional traders and the scepticism over benefits reaching small farmers who numerically dominate Indian agriculture. Agro-processing as a major sector is only in infancy and presents a range of potential forms. While private enterprise, large corporate investment and modern technology can be seen to be prime movers of the development, there is scope for cooperation as well as competition among various sections. Small entrepreneurs, small farmers, women's collectives and non-government organizations have space to operate in the space along with traders and industrial houses..

1.4. Context and Objectives

The cultural, social and demographic changes that the Indian population is undergoing in the wake of liberalization along with technological advances and managerial innovations, motivate food processing to emerge as a major sector in the country. The present study is addressed towards creating a base for reliable estimates of food processing as a manufacturing activity in the current Indian context in the wake of several reform initiatives and to create further discussion and debate to improve the measurement and data protocols for monitoring the fledgling sector. The objective of the study is to make representative estimates of the extent of processing of agricultural products in contemporary India based on scientific and well deliberated methodology.

The study's coverage however transcends food products only and includes in its ambit possible processing of edible agricultural products that take place for non-food purposes as well. The term food processing is thus redefined in the analysis with a focus specifically on agricultural 'food'

products that enter any industry as inputs. Certain products however are not covered for various reasons like lack of data, time, consensus on methodology and redundancy of research. In particular non-edible fibre items produced in agriculture such as cotton, jute, mesta and coir are excluded from the study despite their known significance as inputs in textile, craft and similar industries. Tea, coffee and tobacco that are essentially edible, were historically always linked with industry. All these products received research attention in the past and will not significant value to this report. Also our concern surrounds commercial processing treated only as a manufacturing activity in which the farm produced items are purchased as inputs by the processor for value addition. Thus the service sector, dealing with milling and similar other food conversion services, though important in their own right, is beyond the present scope of study.

The present study is a result of many consultations with expert authorities and several debates, discussions and trials with alternate specifications and methods. It was acknowledged that certain statistics on the level of food processing find cursory mention in literature and in official reports of public and private agencies. The fact that no systematic outlines on methodology, sources and focus accompany these figures provided a case for exploration of the issue and a motivation for conducting the exercises independently in this report for validation of the cited figures and moving beyond with details. It was also found that complexities surround the method of specifications of processing and understanding the data as explained in the following sections. To simplify and summarise the presentation and avoid over-counting, a list of selected items and their sub-groups are drawn out for detailed reporting that considers milled products that are already primary processed, such as rice, wheat flour, milled pulses, sugar and oil. However inclusive coverages are also dealt with separately.

1.4.1. Data sources, Domain of study, coverage and judgemental decisions

This study is based on secondary and official data. The reference period is the post 2000 decade but subject to data and time constraints. In particular we conducted a focused study based on the methodology that was fine-tuned by deliberation only for the year 2005-06 for which all the data was available. The Ministry of Food Processing Industries supported this research with necessary

data as and when required. Such a study can only be done by analysing unit level data collected from enterprises or factories using the laid out procedures for reading the data and using appropriate multipliers[5].

Production data for crops was collected from readily available and time tested sources in the public domain. Even horticultural products data on production is available for the recent decade though the method of data collection is still under development. In the case of livestock, appropriate data on neither meat nor fishes was accessible and so intuitive judgments and recourse to sources other than Ministry of Agriculture were resorted to. Due allowance for seed feed and wastage was to be given for arriving at the denominator for computing the level of processing. For assuming the extent of wastages estimates of post harvest losses made rigorously by CIPHET were used. Allowances for seed and feed were made mostly based on advice received from the Ministry of Agriculture.

Processing is done in both registered and unregistered units identified loosely as typifying the organized and the unorganized sectors respectively. Some of items manufactured in the unregistered sector are used as inputs in the registered units calling for caution while analysing data to avoid over-counting. The annual survey of Industry (ASI) and National Sample Survey Organisation (NSSO) provide input information of the same agricultural item in finely varying forms indicating that some amount of primary processing precedes the substantial processing elsewhere. The inclusion of these items would need finer judgment to the extent they embody processing in the unregistered enterprises.

Identification of the items can be done only so long as ASICC[6] codes are also reported. The domain of study in terms of coverage of items was delimited by the objective of the study which came from the Ministry of Agriculture as a sponsor. In interpreting the term 'food' in the title,

[5] Even then, qualitative inputs from the actual users especially in the corporate sector would have helped to further verify and support our results. This task remains unfinished.

[6] A Standard Industrial Commodity Classification (ASICC)

the emphasis was on edible items from agriculture which enter as inputs in different industries though the finished output may or may not be edible. By this specification inputs like cotton and jute are not be considered in the scope of the study despite being of agricultural origin. On the other hand end-products of edible nature such as many beverages may be manufactured with non-agricultural ingredients but such inputs have no relevance in the study.

Clearly therefore, while food processing activities were found to be covered under NIC code 15 until 2007-08 and by 2010-11 is 10 in the re-categorised set of codes in NIC 2008, actually agricultural items could find uses categorised under other codes too. Thus we chose to work with a larger domain covering all activities coded under NIC, which meant handling a much larger dataset. However we did look at the distribution of uses and found a major role of the group of activities constituting food processing. Though relatively minor in magnitude, shares claimed by sectors like agriculture, hunting and agro-services (NIC 2004 Code 011), tobacco (NIC Code 160), Chemical products (NIC Code 241), pharmaceuticals, medicinal chemicals and botanical products (NIC Code 242) and bio-gas energy and non-conventional electricity generation (NIC Code 401) also deserve attention in view of their future potentials. Problems of analogous but less intricate nature also arose with agricultural data and were solved with information obtained from the Ministry's officials and the researcher's judgment.

A further problem arose with the quality of the 'quantity' data reported by ASI or the ease of its interpretation. Dividing the value data by quantity data the imputed prices are obtained. When the imputed prices were matched with wholesale prices available in public domain the divergences failed to provide required credence for the quantity data or at least for the units of measurement supplied by the data agency. As a way out we resorted to derived quantity data basing our decision on the high level of reliability of the value data reported by ASI as known to researchers. For this the value of input items was divided by the prices as reported by the Ministry of Agriculture presuming that wholesale prices would be close to what organized industries would pay for their inputs[7].

[7] The indirect method was deemed preferable to using reported direct quantity data during the consultations with representatives of data agency CSO.

To sum up, our domain of study covers all possible agricultural products of edible type that enter industry as inputs regardless of the use of the processed product. Both the registered or organized sector and the unregistered or unorganized sector are covered by using data from ASI and NSSO respectively. The purpose was to bring out in quantitative terms the extent of processing of crop based, dairy and fishery products. Given the limitations encountered, using some amount value judgment or received wisdom but with clear specifications and documentation was unavoidable. The proposed study being new and quite unique in nature has no procedure to fall back on despite the presence of estimates drawn from unknown bases.

1.4.2. Understanding the data

Perusing the concept, methodology and coverage of ASI and NSSO data and discussions with officials of CSO helped in gaining over the issues involved, in appreciating the complexity of the data and in working out ways of addressing the constraints. How analysing the data without comprehending the complexity can lead to results of unknown validity is illustrated by some cases outlined in the next two sections. The report represents the summary understanding of the concepts, specifications and methodologies of the data collecting agencies and in our own methodology of analysis, best efforts are made to mention the specifications, inclusions and exclusions and the use of subjective judgments.

1.4.3. Definitional complexities

It was felt that the definition for the purpose of estimating the extent of processing agricultural produces needs to be spelt out clearly taking into account the nature of the items and processes and the availability of information. Deciding the coverage of items and specification of what makes up food processing were the primary challenges.

It was noted that some agricultural items necessarily have to be processed before they can be cooked for consumption. As such, these items are potentially subject to up to even 100%

processing[8] and counting such activities as food processing appears tautological. The hierarchy of processing as applicable to different sets of agricultural commodities therefore needed to be looked at and documented separately. The consensus was not to include processing deemed to be essential for consumption as part of processing in the computation work.

However, we found the process less simple. While for direct consumption, many items required basic processing (such as paddy needs to be milled to rice, wheat to flour) the farm produced form (paddy or wheat) also found use in other activities and industries. Although such uses of these items may be minor, they did not merit complete disregard. There are entries of most grains reported in 'seed' form as inputs in seed and other production processes. Products like oilseeds are both crushed as input into oil (groundnut oil) or processed to snacks (groundnut chikki) or eaten after suitable packaging (mungfali) and value addition (soyabean nuggets). Some of the items in raw form find use outside the food business as in chemicals, biofuels and pharmaceuticals. More intriguingly, some products (like pulses) are consumed by households and industries both in raw form and in milled form.

The lack of distinction of processing activities from essential processing was particularly relevant in the case of cereals rice and wheat and for sugarcane and oilseeds. However, the grey area was actually still larger. Slaughtering of animals seems essential and basic for processing and is mostly done in commercial ventures raising ambiguity about its inclusion. Pasteurising milk is another such activity that is nearly minimal in today's stage of health consciousness. Sundrying, animal feed preparation, grinding, preservation and refining are also simple and common process.

Faced with the perplexing challenges we decided to make a distinction between all agro-processing and the sub-set of value added agro-processing and between primary processing and basic processing by setting our own specifications. First, processing of a relatively simple nature and constituted of activities of widely accepted and common practices is deemed as primary

[8] In reality stocking, export, import, other possible uses of the raw product and most pertinently, errors of measurement may actually create a wedge between production and processing though the wedge can be negative as well. Also, a considering part of such processing is done as a service as discussed later

processing. Second, primary processing which is actually essential for human consumption makes up a category of 'basic' processing by our definition. Viewing all items and activities, we make a judgment about what constitutes primary processing among them, and which primary processing is basic in character. Third, 'Value added' processing is conceptualized as a distinct category of processing that excludes all primary processing and is defined as one that is based on technology and caters to emerging food habits. Our estimates of food processing are of fairly exhaustive coverage's of 'all' agro-processing exclusive of basic processing only. In other words, primary processing except for basic processing as well as value added processing make up the estimates. Estimates of basic and value added processing are however reported for select cases separately.

1.4.4. Additivity

The larger coverage of items, presents a problem, of over counting. For example paddy appeared as paddy seed, unmilled paddy and rice of different forms. Pulses too appeared as milled or unmilled in form but unmilled pulses are also amenable for consumption. Adding up the components for getting a total figure, was not possible because one item (unmilled) could serve as an input in a process from which the output (milled) comes out to enter another process. Excluding unmilled item from our purview is not a solution as it can enter another process as input after in-house milling and not reported by the data protocol. Thus adding up was done only sparingly and using case sensitive judgement estimates are given for agro-products at various stages of processing.

1.4.4. A Survey of Literature

A study of the existing literature on the subject is a usual procedure but was especially emphasized in this study in view of certain estimates emerging in documents. In particular,

'studies already undertaken for other countries if any by international and other reputed organizations' were to be explored to ascertain and explore the possible methodology adopted.

1.4.5. Alternative methods for Consistency checks

Robustness of estimates is important. In one of the early trials, estimates were made based both with ASI (derived) quantity statistics as explained above and with values reported by ASI and India's National accounts (production). The results seemed compatible though of limited value due to the conceptual differences between the value ratios and quantity ratios. An alternative method was also tried out on three specified fruit crops and three specified vegetable crops to reconcile data on production and disposition with the ASI and NSSO reported data on quantities processed. However the exercise did not prove useful due to the haziness surrounding the data and the large gaps between estimates (see Appendix 1). Limited consistency check was possible using the value and quantity data of inputs given by the data agency. Comparison with alternate reports if available raises the case for evolving systematic methods of estimation for credibility.

1.5. Organization

In line with the terms of reference and discussions we have addressed a number of aspects in the study but the focus was on developing a methodology and generating estimates for recent period which are robust, representative and based on most reliable and complete set of data possible. Chapter 2 give a review of international experiences. Chapter 3 then outlines the situation in India's food processing sector in the light of existing literature and a preliminary analysis of secondary data available from officially published sources. Estimation of the extent of processing in India is initiated in Chapter 4 which details the methodology followed and the data used and Chapter 5 presents the results. Chapter 6 concludes the report.

2. The Food processing sector:
A review of literature and Estimates at the international level

Food processing is a growing science and technology and its presence is found to be strong in the currently evolving literature on physical sciences. Sociologists have come forward to address the cultural context of the transformation of the concept of food. In Economics however the literature is hardly vocal on the subject. While there has been some investigation into how the food processing enterprise works as a firm in the framework of industrial economics and though international and reputed agencies in recent times are studying the potential of the sector, the quantified linkage of the sector with agriculture via an ingrained and obvious exchange mechanism remains largely untouched by method-based research. Due to lack of clear specifications and data protocols the subject presents serious constraints for the researcher to delve in. In this chapter we review the state of knowledge on the sector in different countries.

What makes food processing as a sector within industry stand out is its tacit integration with agriculture in the economy and its strategic location in the supply chain. A number of agents generally operate in the space between the producer and the consumer of farm products and the food processors are likely to be some of them. This number depends (inversely) on the degree of integration in the system. More profoundly, investment in the entire space is diffused and its impacts are cross-cutting within the supply chain. Intuitively, the results of investments made on land, labour, enterprise, natural resource management, machines, storage, infrastructure, training and R&D could be implicit in the entire chain if linkages are strong although empirically, this area of study remains largely unexplored. Feed back and spill over effects therefore make the relation among farmers, processors, consumers and other agents synergic.

2.2. Food as a biological need and a culture

The incidences of gains from developing food processing as an industry are diffused but it is from the generation of consumer utility that all the economic agents involved in the chain derive

motivation and pecuniary returns. Thus, any enterprise or public policy towards promoting food processing must keep in view the culture, interest, inclination and education of the consumer with respect to food.

Food provides calories and other nutrients for growth and activity of human body. Nutritionists have convincingly demonstrated that correct feeding is important for a healthy and fulfilling life. Recently even special 'health' foods have appeared on the platters of consumers in advanced economies. Food is today hardly a composite item needed to meet the requirement for staying alive. The type of food, with even its fine variations, is making a difference that can no longer be ignored. With growing scientific knowledge on nutrition, it is admitted that one man's food is another's poison (Doshi, 1995). Food needs are highly differentiated for biochemical processes associated with physiology, race, gender, occupation, age and heredity and the food consumed intimately determines a person's life style. Increasingly, the type of food consumed is seen as a critical determinant of the quality of life and life expectancy.

Yet food is also cultural and ethnic (Baviskar, 2010) in character. People have historically differed in food habits across geographies, religions, customs and races. The same food is accepted in certain societies but is a taboo for others. Customs associate consumption of different foods with different occasions such as celebration and bereavement. Food habit shaped by culture or local geography is often associated with health implications like malnutrition, disease, life expectancy[1]. Positive associations especially among ethnic groups with their food habits have interested nutritionists and commercial food processors. In real life people choose the food they are habituated to but are influenced both by the existing culture and by external shocks composed of information, prices and cultural encroachments. Globalization and higher income are common shocks to existing food systems although there is no consensus that affluence and persuasions coming from large global companies improve food habits nutritionally.

While food shortage is one of the biggest problems of a society, it is also observed that when enough food is supplied, people become concerned with safety and security considerations. The

[1] The association with goiter at higher altitudes and other deficiency diseases in less fertile areas and successful intervention with processing or fortifying of food can be recalled in this connection.

same welfare goals and political compulsions that orient governments towards meeting food needs of the people shift them towards addressing qualitative aspects too in the course of time. Food security begins to encompass a comprehensive connotation that includes along with sufficiently, the quality, content, presentation and convenience embodied in the food. Food processing is an integral component of the science and culture of food and shares in its constitution geography, the customary attitudes, biological impositions and even limitations set by ideological inclinations.

2.3. Origin of modern food processing

While in its simplest form food processing may be as old as the discovery of fire, modern technology driven food processing has a relatively short and recent history of evolution, possibly dating back ony to the middle of the 20th century. Food processing has been defined as a 'synergic application of different physical processes to transform raw animal or plant materials into consumer-ready products' (Sun, 2007). The food industry is expected to prevent and reduce the negative changes in food quality over time, to generate a wide variety of food rich in colour, texture and flavour and to adapt and develop new processes to satisfactorily meet the requirements of wide demographic variety within different cultures. It is also meant to deliver convenience and comfort to household members engaged in making food palatable. Strong scientific foundation is replacing empiricism in food processing.

A driving force behind the contemporary food processing activities was the discovery of a relationship between water contained in food and spoilage of food when observations began to suggest that no micro-organism can grow below a certain critical level of water availability. Also, active water was noted to be even more important than the total presence of water. Scientists began to look for the role of water activity that determined the physical character, processes, shelf-life and sensory properties of food but more recently, other factors and interventions such as altering the pH, the salt content, the addition of anti-microbe agents and heat treatment have also started receiving attention.

The roots of modern food processing are often associated with US army[2]. Novel processing and preservation techniques were developed in the last 40 years in the army for meeting the needs of the soldiers. The methods were designed to produce food and 'ration' with high sensory quality and consumer acceptance while meeting rigorous logistic and shelf-life standards desirable for military combat use. Early research on freeze drying, compression, chemical and biological preservation and flexible packaging evolved into cutting-edge research on novel and emerging processes based on thermal and non-thermal procedures. Irradiation, pulsed electric field, ultra-high pressures, ohmic heating, microwave processing, radio frequency heating and 'hurdle' technology are some of the procedures that were explored intensively. Research on food processing was conducted in collaboration with academic and industry researchers. With success at hand many of the techniques and the produced food are finding their way to commercial market place (Cardello, 2003).

Consumer acceptance and health implications are becoming increasingly important for commercial food processing. Heating has been a conventional method of preserving food but high temperatures are now known to cause undesirable alterations in food such as vitamin loss, reduced bioavailability of certain essential amino acids, flavour loss and modification of taste and colour. Among non-thermal methods, high pressure processing (HPP) is receiving research attention as an emerging method. Biological effects of HPP on the inactivation of micro-organism and changing properties of functional polymers is known for decades but only in the last ten years or so HPP has become a commercial reality (Butz et al, 2002). The method is familiar in America and Japan with respect to fruit jams and juices but in EU the food regulation comes in the way of its implementation.

Besides the physical and chemical transformation processes, sanitization is also becoming a most important component of modern food business. Strict protocols for the complete removal of soil and detergent chemicals (Schmidt, 1997), equipment cleaning and sanitized procedures with specified frequencies of each defined process, removal of food particles seen as potential 'nutrient for micro-organism' on contact surfaces, destruction of bacteria if present, dry storage,

[2] The Natic lab, Ma was on the forefront

regular inspection, appropriate detergent use and training of personnel are important procedures of modern food processing. Critical focus is also placed on other intrinsic and extrinsic factors that influence consumer acceptance of products. Detailed labelling of constituents is also gaining significance as consumers ask for a choice to demand what they want, because the same item can be food for one but 'poison' for another and consumers are getting cognizant of their cultural, physiological, occupational and allergic dispositions with regard to food. Regulation, standardization and branding are becoming integral to the promotion of food processing activities.

The protection of consumers' interests which accompanies the information revolution is a social upheaval. Legal provisions and consumer courts allow arbitration and adjudication of complaints with penalties to ensure consumer justice. In a competitive market regulated for welfare, strictures are placed on advertisement and ethical practices. The government and the civil society both contribute to facilitate formulation of codes of conduct, implementation and grievance redressal with the cyberspace serving as a crucial means of communication and information dissemination. The survival of a food processing industry is therefore reliant on suitable technological training and an effective information system.

Organizational and structural factors are also becoming important. Vertical cooperation with farmers for example by contracts is a way to ensure input quality suitable for production. Besides R&D, adherence to food safety standards, certifications on quality (organic, food safety, labour standard, and pesticide or pest residue) and for environmental management are becoming requisites to gain market access in other countries. The recent move towards globalization via the institution of the WTO has set developing countries on a race to capture export markets. Supply chains are formed with greater care to ensure quality and efficiency. Restructuring of the sector in respect of comparative advantages has also helped development of an efficient sector, the emphasis placed on aquaculture and shrimp industry in Southeast Asia being an example. Developing countries where food processing exists as a large commercial sector but remains tied up in a traditional and unorganised state face the challenges of this transition. Traditional food processing is not only confined overly to certain primary transformations of farm products, but

the lack of awareness and protocol for dissemination of scientific knowledge, absence of labelling, sanitary, labour and environmental standards paint a sharp contrast with the modern version of food processing.

2.4. The food business

Food has been a leading and growing business in western capitalist countries and the business is fast reaching out to the emerging and developing economies as well as the countries that were earlier centralised. Yet, the presence of multinational corporations dealing with food as also engaging in the international trading of food was a historical feature drawn from colonial times. In that situation primary commodities played a strong role and developing countries became exporters of primary products and sometimes importers of processed products. Viewed critically by economists and with apprehension by politicians the multinational companies in business faced ideological resistance and the era of big food business got eclipsed during the period of the cold war.

Today, food business is again emerging in a new form with food processing as a major component driven by the development of technology, the growth of giant companies dealing with processed food and gaining from the opportunities created by trade liberalization. The food processing business has been sharpened in the western world, specifically the US where successful research created ways of value addition to primary products and of marketing the finished products. The procurement system driven by private enterprise also rose to the occasion creating modern supply chains and new opportunities for agriculture. Today, regulation also plays a significant role in guiding the practices in food business.

Interestingly, the organization of the food industry and its integration or linkage with agriculture has also been an important concern in erstwhile communist Russia where deliberations were witnessed on the subject even centuries ago. Alexander Chayanov[i] (1888-1939) distinguished between horizontal and vertical forms of cooperative arrangements while developing a theory of agricultural cooperation in pre-Stalin Russia. Horizontal cooperation, whose most radical

manifestation is found in the full scale communes with co-ownership of fixed assets and land was conceptualized by Chayanov (1966) simply as contractual links among farms who were the basic production units.

The cooperation suggested were in the supply of implements and seeds and in the selling of produce. Vertical cooperation however was viewed as harmonious economic relationships between agriculture and its later stages of food production (processing and retailing of food) actualized as arrangements that allow peasant households to take advantage of economies of scale without undermining economic incentives. This approach was neither hinged on forced collectivisation nor on a competitive struggle between horizontal and vertical cooperation. As will be seen in subsequent sections both the ideas of cooperation were developed vigorously in years to come and ultimately took a most radical form of socialization which it was not purported to be.

The concept closely related to Chayanov's vertical cooperation was 'agribusiness', a term coined in the mid 1950s (John Davis) as part of the progress in vocabulary to keep up with developments. Agribusiness was defined as the sum total of all operations involved in the manufacture and distribution of farm supplies, production operations on the farm and the storage processing and distribution of farm commodities and items made from them. According to Davis and Goldberg (1957) agribusiness essentially encompasses farming, food processing, fibre processing and all other industry aggregates, essentially what the term agriculture denoted 150 years ago. The term later narrowed and typically became associated with the 'trend on the part of giant food companies' to control the whole food chain from 'seeding to supermarket'. Terminologies like 'food chain', 'agrofood-system', 'agricultural commodity chain', 'agri-food complex' and the more generic term 'vertical integration' and 'supply chain' also evolved around the concept.

Finally, the developing countries and the emerging countries are also joining the wave after international market began opening up after the cold war was over. In these countries food processing was an independent activity that stood quite aside from agriculture. The processor

was linked to the producer as well as to the consumer by traders who operated independently. Typically, processing was done in small and informal units. In the last many decades and state intervention and regulation had become hallmarks of food business in developing countries and a form of trading in primary products evolved in which large numbers of traders derived livelihood from the occupation. Small informal enterprises for food processing are creators of employment in these countries. Processing however is largely primary in nature such as milling and crushing of grains, oilseeds and sugarcane.

Food processing was thus always present in the developing economy in commercial form (before kitchen and beyond farm) but not only was this activity of basic and traditional nature but was also conducted largely informally by small enterprises scattered in rural and urban areas. With trade opening up the market and with technology being available for transfer either from domestic laboratories or from other countries to industries there is a visible tendency of these countries to modernise their food processing sector, improve the management, expand the product range and encourage integration with agriculture. For all of this, investment becomes crucial and the relative strength of the small unit needs to be strengthened.

2.5. International estimates of the extent of Food processing

In the fledgling literature on the subject, estimates of the extent of food processing is a rare encounter and even if certain numbers are presented or cited, the methodology followed is far from clear. These estimates do help albeit with their meagre credibility in assessing the size and success of the sector and evaluate its linkages with the nation's agriculture but in a globalized market, interpretations of available estimates can be meaningful if the methodology and data sources are known and if comparable estimates are available from other countries too. They serve as benchmarks, show competitive performances, indicate regional specializations and provide signals on demand and supply in the international markets. Above all, the strength and weaknesses of the methodologies followed set the tone for measurement protocols in the world at large to generate estimates that are more reliable and comparable across countries.

With this perspective a search was conducted to obtain estimates of the extents of food processing in other developed and developing countries. Given that the processing sector is a rising component in the economies of many developed countries, many international and national agencies have conducted studies on the economic potentials and the constraints of the sector and in the process have incidentally reported available estimates. However as seen below the figures are not always uniform for any country and the methodologies based on which the estimates are arrived at are not clearly outlined.

2.5.1. International experiences in Food business and processing

Food processing and food business in general is currently promoted as an economic policy in various countries for different reasons such as for meeting consumer tastes, convenience and nutrition demands as well as for achieving food security of the poor. Reaching out to the export market has probably become the strongest motivation for policy after WTO came to existence. For most countries constraints arise from deep-rooted traditional practices giving rise to resistances to modernising changes as also from the lack of investible resources. Limitation on exports is exerted by the poor managerial practices in the units and their failure to adhere to exacting standards set by the importing countries. Agricultural development is critically linked with the success of the food processing sector because the supply of raw material coming from agriculture is a constraint.

In Russia a Food programme was launched in 1982 prior to disintegration of the USSR to strengthen the coordination within the agri-food system by a bureaucratic (agro-industrial) complex known as APK. This was essentially an application of Chayanov's idea of vertical cooperation[3] dating back to 1920s as discussed earlier (see section 2.4). Although this marriage of agriculture and food processing under the same roof was an answer to the dualism problem plaguing the food system of the country, the original idea of farm's taking over of processing plants became difficult by that time because the collective farms and not the households had

[3] In the centrally planned economy Chayanov's idea of vertical integration was not exploited until its return to the discourses in the 1970s.

become the units of operation. Prior to 1990s processing facilities were inadequate with no concern being shown for quality. Commercialization was weak among farms that catered to the consumption needs of the members of socialized farms only. An estimated one-third of agricultural produce was processed, much less than in many other countries (Ioffe and Nefedova, 2001). As the drive for privatization commenced in the 1990s the organizational structure of the APK changed and a transition ensued, bringing in many international food companies to operate in Russia. Low purchasing power and the lack of incentive and marketing skills however restrained the progress which was also marked by severe spatial concentration.

China, another centralized country, is a large producer and consumer of agricultural products and its weight in international market is rising after its entry into WTO. It is not surprising that China's economic policy today lays special emphasis on the development of the food sector and its export potential. The industry is dominated by small and medium enterprises (SME) mostly located in villages where labour is plentiful. Exports of food products from China are increasingly facing trade barriers from US, EU and Japan, incompatibility of Chinese food standards being a major cause of disputes. There is also a preference for fresh food within the country. In Japan the government policy is to make Japan self-sufficient but with its sizable section of high income people, Japan imports food and constitutes an important organic market within Asia. In Thailand, Indonesia, Republic of Korea, Malaysia and Vietnam food processing and exports are promoted by State but processing remains mostly confined to the SME sector. Export of animal fishery products, horticultural products, cereals tubers are part of the food business. Lack of raw material is a problem in most of these countries besides the outdated methods, poor quality presentation and sanitary practices. In South Asia (Nepal, Pakistan SriLanka and Bangladesh) too food processing is done mostly in SME sector and the domestic market reveals a preference for fresh food. An estimate cited in the course of discussion of the extent of food processing in China is 30% which is less than in western countries where the extent is stated to be between 60-80% (Liu et al. 2007). For India too such unexplained estimates are cited occasionally. Estimates (Table A2.1) given by MOFPI give, reasonably high estimates for horticulture and animal products. The estimates are stated to be based on government's official data but the methodology in not explained.

African countries are importers of and receivers of aid for food but, being richly endowed with natural products (including coffee, cocoa), food processing is also a seen as a way to food security. Cassava, a main staple grown in famine infested areas has been considered for processing into a variety of products (Lancaster et al, 1982).Regional farmers' federations are an instrument for linking farmers with processors.

In US the food processing sector is highly regulated and the degree of regulation is continually increasing to meet the public concern for food safety[4]. The Food and Drug Administration (FDA) is the agency within the U.S. Department of Health and Human Services that is empowered to regulate the sector. Producing a wide variety of exotic primary commodities, the agro-industrial sector in the Caribbean countries unfortunately remains rudimentary and underdeveloped. Lack of significant institutional, technical and financial support (Lambert, 2001), inconsistent and insufficient supply of raw material, seasonality of crops, poor quality of raw material supply are some of the constraints. Chillean agricultural and food processing industries have experienced considerable investment in recent times with a thrust on export (Holand et al, 2001). There is an indication in the literature that the level of processing in the western countries like the US and the EU is very high relative to the Asian and the African countries (Box 2.1) but more rigorous assessments are needed to establish these facts. Websites like those of the USDA and OECD do not officially post any data on the extent of processing till date.

2.5.2. Estimates reported in National and International Agencies and literatures

The scarcity of measures and estimates of the extent of processing is not surprising given that the sector often operates in informal or semi-formal ways in most countries with the borderlines between processing and other food related activities being far from sharp. In most cases some processing is undertaken by farmers either for self consumption or for sale. In certain centralized

[4] Economists have contributed little to the regulation as a public policy in USA (Antle, 1996)

economic systems processing is done within the ambit of collective farms or communes and consumed by the members so that measuring its extent in a commercial sense is as difficult as it is when the food is processed and consumed by the household.

Consumers procure raw or, at best, semi-processed (milled) products and conduct the remaining food processing operations in the domestic kitchen. More intriguingly, the specific activities under food processing umbrella take place in a large spectrum spanning between the farm and the kitchen, making it difficult to delineate what constitutes food processing and what does not. The impression gained from a literature review is that the meagre statistics reported by the agencies include many primary processing such as gain milling, oil-crushing and sugar milling which are essentially unavoidable processes to make food edible. It is also not easy to distinguish the source of raw materials, whether domestic current production, carried over stocks stored in private or public spaces or from exported material. Under certain presumptions, the extents of processing can be large, even exceeding 100% in cases. The comparability of the estimates is also in doubt given the lack of methodological explanations and possible variations in coverage.

Box 2.1 Estimates reported at the international level of the extent of processing

Liu et al. 2007 - In China 30% of food is processed compared to 60-80% in Western countries. The method or source is not mentioned.
D'Essence Consulting , (2009): Country level processing is provided in a table and levels are given as follows - US 80%, France 70%, Thailand 30%, Malaysia 80%, Australia 25%, Netherlands 12%, India 1.3%.
Ioffe and Nefedova, (2001) - Processing level in Russia is stated to be one third

2.5.3. Estimates based on FAO data

A potent source of data that may be useful for estimating the extents of processing in different countries of the world is the Food Balance Sheet (FBS) published in the open domain by the FAO in FAOSTAT. An FBS presents a comprehensive picture of the pattern of a country's food disposition during a specified reference period. The food balance sheet shows for each food item

i.e. each primary commodity, its availability for human consumption which corresponds to the disposition and its utilization.

The total quantity of foodstuffs produced in a country added to the total quantity imported and adjusted for any change in stocks is the availability. On the utilization side a distinction is made between the quantities exported, fed to livestock, used for seed, losses during storage and transportation, and food supplies available for human consumption. The data is employed to obtain the per capita physical supply or availability of each such food item by using population data. This data is basically deemed to be important for assessing nutritional adequacy and balance through the application of appropriate food composition factors for all primary and processed products in terms of dietary energy, vitamins, protein and fat content.

Although the data serves an important service for adjudging country level nutritional status, because utilization of supply by different uses is available, the data in principle can also be amenable for assessing the country's extent of food processing. The estimate can be expressed as the ratio of production that is processed. Theoretically, for example, more than 100% of the currently produced grains can be milled if there are unaccounted carryovers. The available amounts also consist of imported components so that even items that are scarcely produced in the country are likely to register statistics far exceeding 100% if the country is strong in the relevant processing capacity. Processing can however be expressed in relation to currently available supply of the raw material by including opening stocks and imports and ruling out closing stocks and export. Estimates of wastage of products and their use as seed or feed that diminish the availability for processing are also reported by FAO.

Extent of Processing = Processed amount/Net Supply where

Net Supply= Production + Import - Export + Stock variation- Seed – Feed -Wastage

Where stock variation=opening stock-closing stock and all the variables relate to the same calendar year.

The coverage of the crops is as follows:

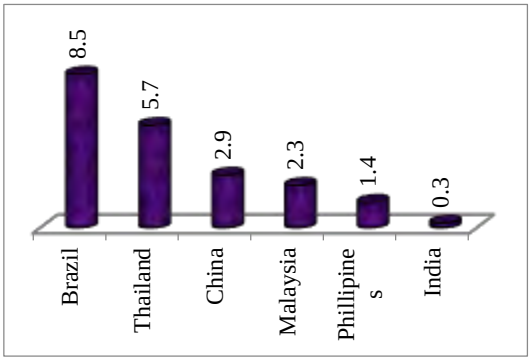
Fruits include: Apples, Bananas, Citrus (other), Dates, Fruits (other), Grapefruit, Grapes, Lemons(limes), Oranges(mandarines), pineapples, plaintains.

Cereals include: barley, maize, millet, oats, rice (milled), rye, sorghum, wheat, cereals(other)

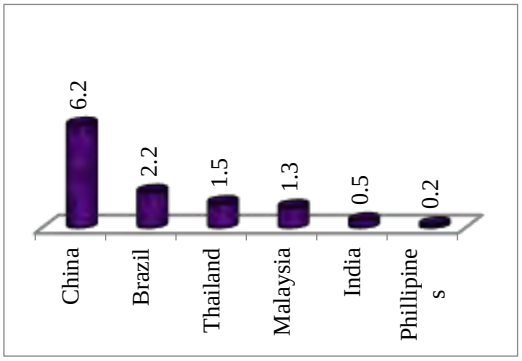
Oilcrops include: coconut (incl copra), cottonseed, groundnuts (shelled eq), olives, palmkernels, rape and mustardseed, sesamseed, soyabeans, sunflowerseed, oilcrops (other).

Sugarcrops include: sugar cane, sugar beet.

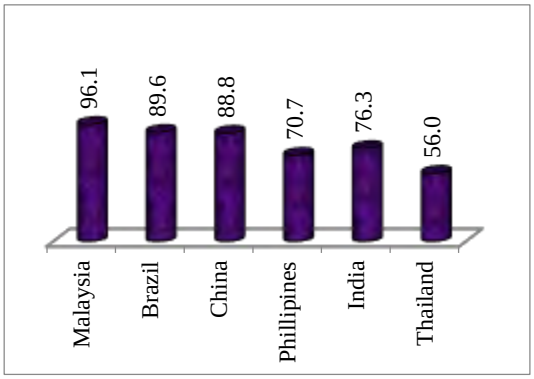
The estimates given in Table A2.2.1 are therefore constrained by the data that is actually available for analysis, limitations of the compiled country level data (see Appendix 2.2 Notes to Chapter 2) the uniformity of the coverage across different geographic, socio-political locations, the opaque specification of processing and the crude assumption of the utilization and the production reference periods. Although the extent is low in general between 0.26 (India) and 8.5 (Brazil) the processing of cereal does exhibit a tendency to increase in the 2000s decade in all the select countries except Philippines. Similarly fruit processing also shows improvement in some of the countries but Philippines, China and Brazil are among the exceptions. Processing of oil crops and sugar crops which essentially signify milling of seeds and canes into oils and sugar respectively is obviously high in extent. Oil crop processing is also increasing in extent except in India which is an importer of processed oils and in Philippines. Sugar crop is nearly 100 % in all cases but Malaysia and India record lower extents.



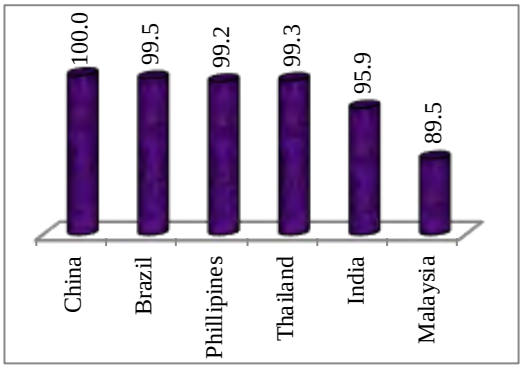
(a) Cereals



(b) Fruits



(c) Oilcrops



(d) Sugar Crops

Figure 2.1: Share of available agro-products processed in developing countries (%) including China and India in 2009-10

For these basic levels of processing, a relatively lower figure could mean that processing is done at the household behest and not commercially. As such the extent of processing of cereals (milled) and fruits seem to be reasonably low and those of other items that require basic processing is very high. It is hard to decide whether this data influence the reports on extent of processing given in Box 2.1. Figure 2.1(a-d) plots the figures for the year 2009-10 showing India's position ranking low among the six selected countries. Similar estimates (not reported) for the period 2007 to 2009 work out to reasonably high values in France (nearly 50% for fruits, 35% for wheat and 95% for oilcrops). The level of cereal processing is found to be above 70% in US, above 15% in Russia, above 20% in Netherland. Fruits processing is about 10% in USA and Russia.

[i] Alexander Chayanov (1888-193) lost his life in Stalin's purges.

3. Food processing in India: Policy and Performance

India has a large agriculture base and her food production has grown phenomenally in the new millennium but poverty is a dominant feature of India's rural sector. On the other hand, the growing urban affluence has brought changes in demand patterns. Agriculture's response to these signals is also perceptible in the emergence of sub-sectors like livestock farming and horticulture (Kumari et al, 2012, Gokarn and Gulati, 2006). These structural transformations with agriculture are creating challenges in agricultural marketing as the market developments need to translate to enhanced farm incomes. The agricultural products must also reach the ultimate consumers with minimum losses both in quantity and intrinsic quality.

Many of the farm products especially animal based products, horticultural products and also some of the traditional crop products are amenable for processing into food products or other end uses. Processing may be seen as a way to longer preservation of food complemented with added flavour, taste and convenience (see Appendix 3). In the following sections secondary aggregate level data on food processing including beverage and basic processing as identified by NIC code 15 from 2000-01 to 2007-08 and 10 and 11 from 2008 onwards is analysed to mark the performance of the sector in India in the 2000s.

3.2. An overview of India's Food processing sector and its constraints

India's FPI is estimated to be at USD 67 billion (Rs 3600 billion) and the entire food industry at USD 180 billion (KPMG-ASSOCHAM, 2009). It is also believed to present the largest employment opportunity per unit of investment. India's share in global processed food trade is only 1.6% but is expected to increase to 3% by 2015 (NSDC, 2010). Major states engaged in food processing are Andhra Pradesh specializing in fruits, vegetables and grains, Gujarat leading in oil and dairy, Maharashtra with fruits vegetables, grains and beverages being strong points. The level of processing however is considered low in relation to the quantum and variety of items produced by India's agriculture. India is the world's largest milk producer growing at a

rate of 4% annually, second largest producer of fruits and vegetables accounting for 10.9% of global fruit production and 8.4% of vegetables. India is the largest producer and consumer of pulses.

With wide agro-climatic diversity, over 1 billion population who spend over 40% of household expenditure on food, rising literacy rate and per capita income, growing urbanization and with independent judiciary and press, India presents possibly the biggest emerging market in the world. Cheaper workforce compared to many parts of the world, higher literacy and large agriculture are factors that favor its growth in the country while liberalization and changing gender roles create the suitable ambience for its acceptance. India's agriculture has traditionally been cereal centric but given that substantial opportunities of processing fruit and vegetable, meat products, dairy and marine products exist there is a synergy between diversification and the rise of the food processing sector.

The Indian food processing industry benefited from liberal trade and industrial policies (Bhavani, et al., 2006) making the food industry one of the fastest growing sectors in post-reform India. The food processing sector constitutes 9 to 10 per cent of GDP in Agriculture sector (Rs. 638,301 crores) or Manufacturing sector (Rs. 774162) in 2010-11. The growth rate of the sector went up to 13.7% in 2008-09 from 6.7% in 2004-05 surpassing the growth rates in both agricultural and manufacturing sectors (Sharma and Bathla, 2012). The industries also became more organized and the composition too changed in the period. Being deemed as highly labour absorptive and less capital intensive in nature compared to other industries the sector carries much weight for the future of Indian economy. It constitutes 13.6% of the employment generated in the manufacturing sector in 2010-11 (MOFPI, 2012). Food processing also offers vast possibilities for agriculture.

India produces more than 250 million tonnes of different food grains every year and most require some form of milling. The variety of grains is large covering rice, wheat, maize and other coarse cereals. Grain based products are the largest contributor of the FPI accounting for about 30% of revenues. Rice milling capacity is 200 million tones. Oil, pulse and flour milling are also major

segments in milling (KPMG-ASSOCHAM, 2009). Over 90% of the produce falls under the primary processed food segment (NSDC 2010). India has a large oilseed and oil sector but much of the oil consumed in the country is imported. India is next only to EU and China in the import of vegetable oils.

In India historically the processing of fruits and vegetables by simple measures like pickling, sun-drying and making preserves have been a household practice since ancient times but modernised practices were generated by the military needs at the time of the first World War and more so during the Second World War. While processing fruits and vegetables on a commercial scale is progressing at a reasonable speed, the policy thrust on diversifying agriculture for more efficient use of land resources reverts attention to the possibility of processing food.

Grain is purchased in unmilled form by consumers from the public distribution system and milled or unmilled form from private retail stores. In case of unmilled produce, milling service is purchased by consumers from local millers. Commercial grains milling is traditionally done locally but today grains are increasingly branded as wheat powder (atta, maida, suji) or rice of different variety to be available at affordable prices from the manufacturing sector. Further, new food products are produced to add value to maida.

The breakfast cereal segment is also growing in line with social changes and has immense potential of reaching out to affluent urban consumers who prefer easy to make, fortified and tasty cereals over traditional meals. Health consciousness and informed sensitiveness to contents of gluten, fiber and nutrients create varieties in milled products at a finer level. The Indian confectionery market is segmented with strong regional players and the presence of branded products is small. The chocolate market is however dominated by two major players (Cadbury and Nestle) with global exposure. The soft drink industry is the third largest packaged food industry in India after tea and biscuits with over 100 plants and a large export market. Beverages like colas, lemonades, squash and fruit punch are popular soft drinks although till now consumption is more confined in urban areas.

The major growth segments in Indian FPI are identified to be fruits and vegetables (pulps, juices, ready to serve beverages, jams, squashes, pickles), dairy (packed milk, ethnic sweets, curd products, ghee and milk powder), meat and poultry (buffalo meat, mutton, lamb, poultry), marine products (fresh fish, frozen shrimps, fins, cattle fish and squid) and beverages alcoholic (beer, wine Indian made foreign liquors) and malted. Demand for organic food free from conventional chemicals characteristic of traditional systems of farming opens up new avenues in the international market and more health conscious domestic market. By default most of Indian farming is organic with minimal use of agro-chemicals and with no use of GM seeds but the export of organic produce is low. For similar reasons a market is emerging for diet and low calorie foods. Packaging of food products is also providing convenience food whose demand is likely to grow. India presents a huge untapped opportunity for the food processing sector enhanced by low penetration levels and a liberal regulatory regime (KPMG-MOFPI-FICCI, 2007). The retail boom that is emerging may be a strong driver to the developments.

The constraints to the growth of the food processing sector are also many. Fruits and vegetables are highly perishable and wastage is high due to poor cold chain linkages during storage and transportation. Despite the largest bovine population, low productivity of milch animals in India, and the lack of scale economy are restraints. In meat and poultry quality and hygiene is low in street side wet markets but imperfect slaughtering, lack of slaughtering facilities, outdated rearing and high feed costs are other problems. International trade rules and increasing protectionism in export market contradict with poor performance of agriculture and primary sector due to small size of farms, poor resource availability, environmental factors and seasonality. Poor seeds and technology, small scale, mostly manual operations, limited use of technology, poor supply chain facility and cold storage, continuing preference for fresh food among consumers and poor yield of crops and milch animals are hurdles in the industry. Thus performance of agriculture, both crop and animal based, has a major role in the growth of the sector just as the FPI can also create demand and income for agriculture.

3.3. Policy imperatives and options

The rationale for promoting food processing lies strongly in its linkages with agriculture. Employment generation, reduction of product losses and export potential are other motivation. There is apparently a strong mutuality of relation patent between agriculture and processing. Any efficiency gain in primary agricultural production can be transferred to food processing via the decline in input prices and rise in total factor productivity (TFP) while the consequent efficiency gain of the food processing industry can in turn be partly transferred back to the primary agriculture through increased derived demand to mitigate the price decline also (Gopinath et al, 1999).

The nature and magnitude of the linkages between the two sectors carry special importance for public policy which can influence the drivers of TFP (such as public investment on R&D and legislations to encourage the flow of private investment into the sector). Given the possibility of the valuable spill-over effects it is important to understand the extent of externality and social profitability for public interest. In a locational perspective, the importance of spillover from rural to urban communities was also amply recognized (Robison and Meyers, 1992) but a lack of quantified studies on contribution of agriculture to urban economies as opposed to rural economies comes in the way of educating the public of the importance of agriculture. The linkages between food processing and agriculture viewed as an interaction between urban (core) centres and (rural) peripheries offers areas of research that can be useful to policy making[1].

Food processing is generally viewed as a labour intensive sector and a panacea to unemployment problem although at the formal level the evidences are less clinching and theory is ambiguous.

[1] An interregional, core-periphery input-output model used to assess economic linkages between the Ouachita Parish as an urban core and a nine-parish rural periphery in the Monroe, Louisiana Functional Economic Area (FEA) in US found a small multiplier effect with the core providing mainly higher-order services to the periphery (such as medical services), while the periphery tended to provide the core with natural resource-oriented commodities (Hughes and Litz, 1996),

Food processing is also described as 'capital intensive industry' which 'lacks short run flexibility on capital and non capital inputs' (Morrison, 1997) due to its emerging and growing nature.
The urgency to minimise wastage as another measure towards efficiency is another ground for exploring modern food processing as an instrument. The world devotes considerable resources (soil, water, land, fossil fuel, and atmosphere) to producing food so that product loss translates to wastage and avoidable degradation of resources (Fox and Fimeche 2013). Promoting the processing sector will not only help in preserving the products longer but will hopefully draw investments in supply chains to reduce post harvest losses.

Food processing can also be a way to enter the world export market in food business exploiting India's advantages of wide climatic variety and cropping patterns. Trade reforms as a follow up of India's entry into WTO provides a necessary thrust to the sector to gain competitive strength but while at a multi-lateral scale trade and investment-related reforms in agro-processing together can help the sector to grow, unilateral reforms, especially those that improve productivity in agro-processing and in primary agriculture, are more important to agro-processing (Kumar et al. 2006). The development of a competitive processing sector will help agriculture and the small units to gain access to technology and modern practices of world standard.

3.3.1. A Separate Ministry

The Ministry of Food Processing Industries (MOFPI) was first set up in July 1988 to give impetus to the food processing sector in India but in 1999 the Ministry was brought under the ministry of Agriculture as a Department. Again in 2001, vide a Cabinet Secretariat's note it was notified as a ministry. The reinstitution of MOFPI was motivated by the feeling that a strong and dynamic food processing (FP) sector could play a vital role in diversification and commercialization of agriculture, enhance shelf-life and ensure value addition to agricultural produce even while generating employment, increasing far incomes and promoting export. The MOFPI is concerned with the formulation and implementation of the policies and plans for the FP industries within the overall national priorities and objectives. Along with the Ministry of

Agriculture's own efforts the MOFPI can be instrumental in meeting the challenge of ensuring remunerative prices to farmers.

As distinct from the Ministry of Agriculture, the MOFPI is allocated subjects like the processing and refrigeration of certain products like milk and milk products, processing including canning and freezing fish and providing technical assistance, processing including freezing and dehydrating fruit and vegetable and milling of grains. Planning, development and control of other food industries as well as packaging of products are also components in the MOFPI's portfolio.

The Ministry aims to promote and better utilize agricultural produce, minimize their wastage, introduce modern technology, encourage R&D and provide policy support and infrastructure to facilitate the operation of supply chains. Among the outstanding initiatives of the MOFPI was the historic exemption of many processed foods from the purview of licensing under the Industries Act 1951. A small group of items remained reserved for small scale sector. Other policy initiatives include automatic approval of foreign equity up to 100% for most processed food items, developing strong supply chain for perishable farm products and building infrastructure to enable value addition.

The MOFPI also undertook development initiatives like widening of R&D base, human resource development, assistance for setting up testing laboratories. Two national level institutes one in Tamilnadu and the other in Haryana and an integrated Food Law (Food safety and Standards Act notified by the Government of India in 2006) to removed multiplicities of laws and regulatory agencies were steps in this direction. Decentralization of processing and disbursement of grants were other developments. A new centrally Sponsored Scheme named national Mission on Food Processing is also launched during the 12^{th} Plan 2012-13 to decentralize the implementation of Ministry's schemes leading to greater participation of the State governments. The MOFPI also provides assistance for organizing workshops, seminars, exhibitions and fairs and for conducting studies or surveys.

3.3.2 Gender Concerns

Traditionally and non-commercially, food processing is conducted in the domestic domain mostly by women as a specialization as laid down by the social norms and stereotyping that are today encountering transformations. Nevertheless, expertise gained in a historical legacy probably gives women an advantage in food processing that can be commercially exploited. At the informal level, farm women are given encouragement to engage in food processing as an enterprise. Evidences suggest that there is considerable scope for empowering women through this route (Ghosh, 2013_b) and integrating this objective with the scheme of promotion.

MOFPI recognizes the contribution of women in food processing, women being traditionally specialized in many such activities. A Gender budget cell has been set up to address gender balance. There is an attempt to maximise the benefits accruing to women stakeholders although till now no quantified estimates have been made, Beneficiaries of Ministry assisted projects include those engaged in the supply of raw materials to food processing industries in working for processing plants and in marketing at the downstream levels. A Working Group on Food processing Industries recommended the continuation of the schemes on infrastructure development, institutional strengthening and quality assurance and food safety.

3.3.3. Food Parks, Integrated cold Chains and Safety issues

The Twelfth Five year Plan has emphasised two schemes for infrastructure in India namely mega Food Parks and Integrated Cold Chains. Mega food parks aim to provide a mechanism to bring together farmers, processors and retailers and link agricultural production to the market so as to ensure maximisation of value addition, minimisation of wastages and improvement of farmer's income. Creation of an integrated value chain with processing at the core and with forward and backward linkages is important goals recognized. Between 10 and 100 hectares of identified land will be allocated in 30 locations all over India for the Parks, supported by government grants but set up by private consultants. Each Park will have a catchment of at least five districts. The chain

developing from the farm gate to the retail shelves will have collection and distribution centres and central processing centres in between for sorting, grading and packaging along with irradiation, incubation and development for commercial success.

Wastage due to gaps in supply chains results in instability of prices, unremunerative farmer prices and unsustainable use of natural resources. In the Eleventh Plan period MOFPI started providing financial assistance to proposals received from public and private organizations for integrated cold chain infrastructure development. This scheme is continued in subsequent Plan period also. Government encourages setting up of integrated cold chain facilities to improve storage and reduce wastage by not missing any link in the value chain from the farmer to the consumer or retailer.

As in many western countries, food safety is becoming an issue in India too. Food safety and quality is also important for competitiveness in the global market. The year 2008-09 was celebrated as food safety and quality year by MOFPI. Initiative taken to bring awareness of food quality issues amongst consumers, industries and other stakeholders include a number of programmes conducted by MOFPI in collaboration with Quality Council of India, Industry and Trade bodies (CII) and NITFEM[2] (National Institute of Food Technology Entrepreneurship and Management) institute. Setting up of food testing laboratories and implementation of HACCP/ISO 22000 is part of the quality assurance scheme of MOFPI. The MOFPI also provides inputs to various shadow CODEX committees of the UN and the contact point in India is Food Safety and Standards Authority of India. CODEX Alimtarius Commission, an international body constituted by WHO and FAO to protect the consumer health and fair practices in food trade prescribes international standards for safety and quality of food and good manufacturing practices, guidelines that are recognized in international trade negotiations and settling disputes by WTO.

2 NIFTEM is the brainchild of the Ministry of Food Processing Industries (MoFPI). MoFPI in its Vision document-2015, envisaged creation of a world-class institution to cater to the various stakeholders such as entrepreneurs, industry, exporters, policy makers, government and existing institution. NIFTEM would work actively in assisting in setting food standards, businesses incubation and information sharing. It would also be an apex institution in the field of food technology and management, networking and coordinating with other institutions in the same field. (Wikipedia)

3.4. Current situation in India

A major advantage of promoting food processing sector lies in the common perception that it generates employment drawing on the existing skills of the people supplemented by modern technology. A large portion of the sector being in the informal sector creates further possibility of drawing in poorer and semi-skilled population in the employment net. Thus it may be conjectured that the food processing sector is an instrument to make economic growth more inclusive. In this section we look at the status of the food processing sector in India identifying it by the NIC 2004 code 15 (food processing and beverages) and assessing its performance primarily by its employment creating ability.

Food-processing is still done mostly in the unorganized sector in India although with the entry of many large industries into food business, the unorganized enterprises today have less than 5% of the share in the total value of output generated of processed food items. They however continue to constitute an overwhelming majority of the units (Table 3.1). They generate nearly 80% of the employment created in the entire sector and also have a considerable share (about one fifth) in the material consumed possibly reflecting their access to cheaper agro-inputs while the organised sector with a 75% share in the value generated is suggestive of superior efficiency.

Table 3.1: Share (%) of Organized and unorganized sectors in food processing activities (2005-06)

Sector	Enterprises	Employment	Value of outputs	Materials
Organized	0.90	21.09	75.5	80.51
Unorganized	99.10	78.91	24.5	19.49
Total	100.00	100.00	100.00	100.00

Note and Sources: Based on ASI and NSSO data for 2005-06

Figure 3.1 (a) amply shows that food processing industries in the organized sector has undergone remarkable growth in the period both in nominal value and after adjusting for inflation but this is matched neither by the growth of the number of units nor by the employment generated. This is a reflection of a growing concentration within the industry and jobless growth in the sector. In the unorganized sector in which the vast majority of the units belong, the tendency is one of decline

(figure 3.1(b)). While there has been growth in the number of units as well as employment in the organized sector, in the unorganized sector the number fell from 30 lakh in 2000-01 to 26 lakh in 2005-06 and further to 22 lakh in 2010-11 and during the same period employment of workers too fell continuously from 68 lakh to 52 lakh to 48 lakh (Figure 3.1 (b)).

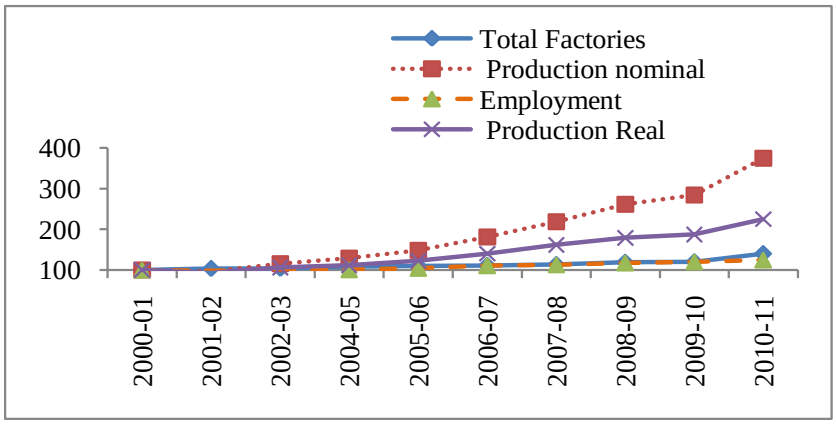


Figure 3.1 (a): Growth (Index) of organised sector in Food processing in decade 2000s. Source: ASI data

Figure 3.1 (b): Food processing sector in the Unorganized sector in 2000s Source: NSSO data

Table 3.2: Organized and Unorganized sectors in Food processing in India

	Enterprises (No) Organized	Enterprises (No) Unorganized	Value added (Lakh) Organized	Value added (Lakh) Unorganized
2000-01	21649	3011300	1644731	466751.5**
2005-06	23734	2602807	2345568	1540575
2010-11	30253	2241195	5521147	2205400
Increase (%)				
2000-01 to 2005-06	9.63	-13.57	42.61	230.06
2005-06 to 2010-11	27.47	-13.89	135.39	43.15

Sources: National Sample Survey Office (various) and Annual Survey of Industries (various)

3.4.1. The organized sector

In the organized sector the total number of factories rose from 21.6 thousand in 2001 to 30 thousand in 2010-11 by 40%. The employment generated in the sector also increased but by less than 25%. The average annual growth during the same period was less than 3% for employment and 4% for the number of units. In the same interval the average per factory generation of value of output increased from 6 to 17 crores (168%), of income generated from 0.5 to 1.4 crores (184%) but that of employment fell from 61.5 to 54.9 per unit by a dismal 11% (Table 3.3).

Table 3.3: India's organized food processing sector in 2000s

Year	Total Factories(Number) (In number)	Value of Production (Rs'000 Crore)	Materials Consumed (Rs'000 Crore)	Income (Rs'000 Crore)	Employment Lakh number
2000-01	21649	135.52	107.54	10.52	13.33
2001-02	22395	130.35	103.76	9.74	13.07
2002-03	22490	157.00	129.23	8.25	13.08
2004-05	23471	175.41	144.48	12.45	13.43
2005-06	23734	201.28	162.59	18.10	13.92
2006-07	23951	246.02	194.97	28.56	14.76
2007-08	24616	296.66	243.21	26.79	15.05
2008-09	25788	354.69	292.62	30.30	15.64
2009-10	25915	385.47	317.50	33.21	16.06
2010-11	30253	507.58	422.75	41.79	16.62
Average growth%	4.42	30.51	32.57	33.02	2.74

Source: Annual Survey of Industries (various)

Employment is a key indicator of the expansion of the sector in India where the population pressure is intense and the challenge of a shrinking presence of agriculture in terms of GDP looms large in the wake of economic growth. Considering five broad sub-groups categorised by NIC codes, the structural change within the food processing sector in the organized sector though noted was not found significant in the 2000s decades. The largest employment generator is the manufacture of food produced like bakery and confectionery.

Manufacture of dairy products and that of beverages both constitute only 5% to 6% share in employment and respectively made 1% and 1.5% gains in the share of total employment. A slightly higher gain of 3% increase is made by processing and preservation of meat, fish, fruits and vegetable, oils and fats which has now 13.7% share. This was made up by the fall in the share of manufacture of other food products while the primary processing sub-group manufacture of grain mill, starches and animal feed remained unchanged. Incidentally, the losing sub-group *manufacture of other food products* is (bakery, sugar and sugar products, confectioner, cocoa products, macaroni etc.) is the largest one among the five accounting for over 50% shares. The next most important sub group grain milling that accounts for a quarter of the employment in the sector (Table 3.4) is stagnant.

Table 3.4: Share of sub-sectors of food processing in employment in organized sector (%)

	Production, Processing and preservation of meat, fish, fruit vegetables, oils and fats	Manufacture of dairy products	Manufacture of grain mill products, starches and starch products and prepared animal feeds	Manufacture of other food products	Manufacture of beverages	All sub-sectors
NIC 2004	151	152	153	154	155	15
2000-01	10.63	5.04	23.31	55.11	5.91	100.0
2005-06	12.54	5.70	23.36	51.52	6.88	100.0
2010-11*	13.67	6.08	23.39	49.19	7.67	100.0

Source: Annual Survey of Industries (various) years, * categories were adjusted for the new codes in 2010-11

While compositional change of employment in terms of product structure was moderate, the character of employment generated in the organized food processing industry was more remarkable. While the total employment increased by a little more than 2 lakh between 2000-01

and 2010-11, there was a modest swing in favour of workers from supervisory staff (76.5% to 78.2%) but a more conspicuous swing from direct employment to employment via contractor (16% to 24%) among the workers (Table 3.5). The gender balance remained ambiguous with the share of women among workers increasing from 16.4% to 17.6% from 2000-01 to 2005-06 but fell below the 2000-01 level in 2010-11. Women do have a moderate share above 15% in employment but no change is evident in the share.

Table 3.5: Employment in India's organized Food processing Extent and quality

	Workers %	Directly %	Contract%	Women%	Total Employment
2000-01	76.53	60.81	15.71	16.37	1332588.00
2005-06	78.50	57.98	20.53	17.61	1391616.00
2010-11	78.21	54.29	23.92	15.56	1661598.00

Note: Total Employment is number of persons and other figures are percentages of total employment. Source Annual Survey of Industries (various)

The figures 3.2 provide further break-up of the enterprises and employment among activities leaving out the single largest group constituted by *Manufacture of grain mill products, starches and starch products and prepared animal feeds* which is mostly primary or even basic in nature. While the importance of the group producing other food products (bakery, confectionary etc) in employment generation is already noted, products like cocoa and macaroni are identified.

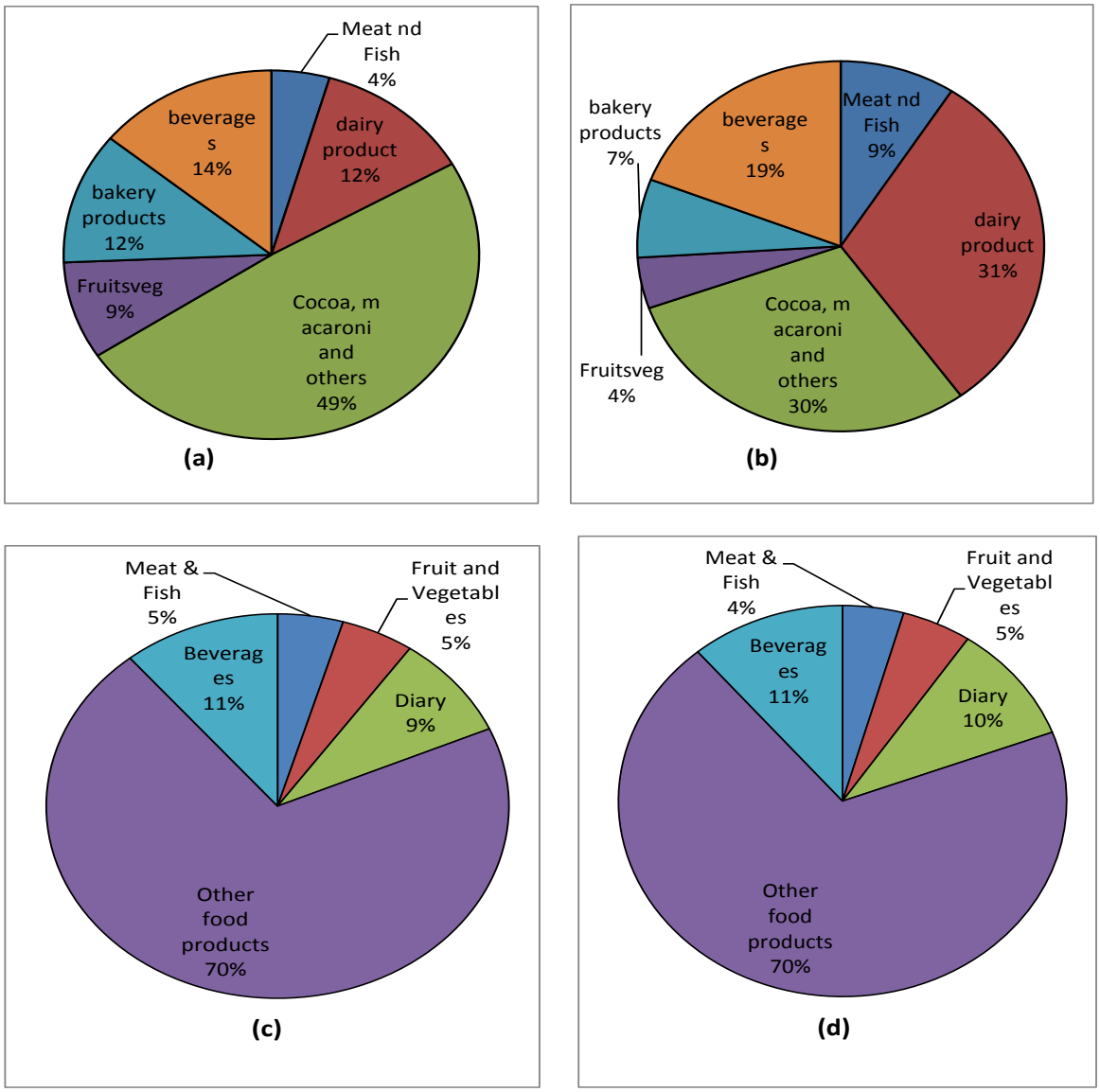


Figure 3.2(a): Enterprises in different food processing sub-groups (2010-11): (a) No of Units (b): Value of products © Worker (d) Total Employed

3.4.2. The unorganized sector

Table3.6 : Food processing industry in the unorganized sector (including beverage)

year unit	No of factories number			Workers total number			Workers per unit number		
Sector	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
2000-01	2360700	650600	3011300	5171100	1670900	6842000	2.19	2.57	2.27
2005-06	2075265	527542	2602807	4963717	1382051	6345768	2.39	2.62	2.44
2010-11	1545962	695233	2241195	3090362	1702200	4792562	2.00	2.45	2.14

Source :National Sample Survey Office (various)

In the unorganized sector the total number of enterprises declined by 25% and the employment by nearly 30% between 2000-01 and 2010-11. In fact both the number of units and employment registered falls in the rural sector (table 3.6). In the urban sector the enterprises rose in number although a marginal increase in employment is observed. The employment of worker per unit remains static and low. The share of the rural sector in the number of enterprises and in employment improved between 2000-01 and 2005-06 but the tendency was completely reversed in the findings in 2010-11 suggesting a growing tendency for urban concentration of informal units (Figure 3.3).

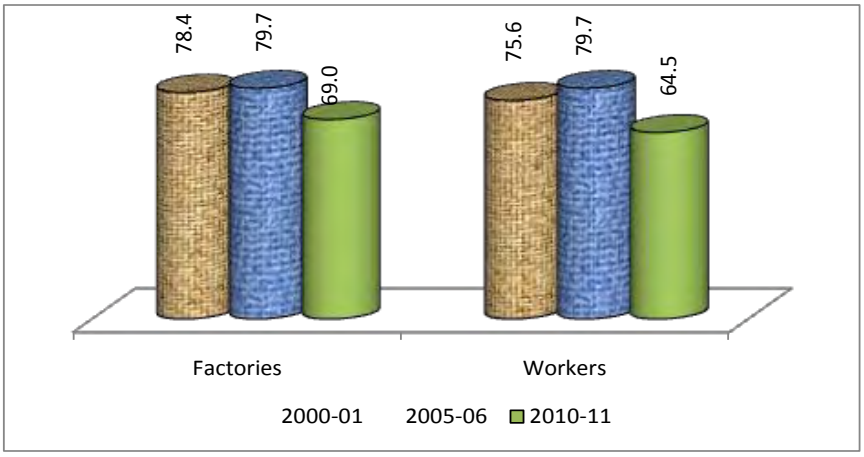


Figure 3.3: Share of Rural sector in Food processing industries in the unorganized sector Source: NSSO data

The traditional food processing enterprises generate considerable employment among the semi-skilled workers and being spatially scattered, the employment is also generated in the rural part of the country. However, in this frame of operation, there are large compromises on quality, safety, quantity, nutritive value and efficiency. Lack of standard norms, transparency on the inputs used and social protection of the workers involved in processing in the unorganized sector undermines product quality with health implications for consumers and also helps to bind large sections of the population in persistently low income occupations. With greater health consciousness and affluence of urban educated middleclass and the entry of larger companies often with tie-ups with multinationals, the unorganized sector seem to have encountered a set-back and an urban bias. There is an urgent need for public policy to help these units get equipped to face the challenges and resurface with added strength. It is in building up the small enterprises in the organised sector in processing food in ways that are consistent with best practices and competition enabled that the challenge of the MOFPI lies.

3.4.3. Regional spread

Table 3.7 suggests that the unorganized enterprises have a spatial diffusion more scattered than the organised sector in which four states Andhra Pradesh, Tamilnadu, Punjab and Maharashtra account for over half the total number of enterprises. The leading states to accommodate the largest numbers of small units are Uttar Pradesh, West Bengal and Odisha. The southern states barring Andhra Pradesh and Kerala do not report unregistered food processing units and the northeastern states though strong in production of horticultural items and states like Bihar and Jharkhand have a small share. Andhra Pradesh and Punjab have a higher share in registered units and states like West Bengal, Uttar Pradesh, Odisha, Rajasthan, Himachal Pradesh, Jammu Kashmir and Madhya Pradesh have greater share of unregistered units. The dominant state in the number of units also has a larger share of the rural sector in the location of the units. Thus in Andhra Pradesh and Tamilnadu the rural share in registered units is over 20% and in West Bengal and Odisha the same share is over 10% in respect of unregistered unit.

Table 3.7: State-wise percentage (%) share of Enterprises in India

	ASI		NSSO	
Name of state	Total	Rural	Total	Rural
Andhra Pradesh	22.30	24.64	8.17	7.84
Tamil Nadu	21.08	25.20	0.00	0.00
Punjab	8.23	5.97	1.55	1.15
Maharashtra	8.15	6.11	9.30	7.28
Uttar Pradesh	5.61	5.33	22.07	23.15
Karnataka	5.09	4.02	0.00	0.00
Gujarat	4.63	3.26	4.78	3.86
Kerala	4.39	5.83	4.87	4.47
West Bengal	3.63	4.14	18.09	20.25
Assam	3.03	4.33	0.00	0.00
Chattisgarh	2.30	1.59	0.90	0.87
Orissa	1.98	2.57	13.57	16.01
Haryana	1.89	1.49	1.73	1.23
Madhya Pradesh	1.68	0.85	4.46	3.74
Rajasthan	1.64	0.84	5.94	5.36
Uttaranchal	1.39	1.21	0.74	0.77
Bihar	0.58	0.53	0.04	0.00
Jammu & Kashmir	0.34	0.27	1.32	1.31
Delhi	0.33	0.00	0.15	0.02
Himachal Pradesh	0.33	0.40	1.53	1.84
Jharkhand	0.32	0.19	0.00	0.00
North East States	0.27	0.29	0.62	0.67
Others*	0.81	0.93	0.17	0.15

* denotes Pondicheri, Goa, Chandigarh, Daman & Diu, D & N Havelli, A & N Islands and Lakshdweep. Source: ASI and NSSO. NSSO does not report enterprise under FPI in certain states.

4. Estimation of the Extent of processing of Agro-Products in India: Method

The objective of this report is to create estimates of food processing and similar activities under the agro-processing umbrella. The methodology is developed collaboratively with caution and is open to debate. Official national level secondary data from alternative sources are used to ensure reliability and robustness. This may be a first of this kind of endeavour for the purpose and assembles the insights, field based knowledge and serious reflections made by scientists, government officials and statisticians at several consultations held with the author in the course of the study.

The extent of processing of agricultural products will be worked out using unit level data collected by official and expert agencies of the Government of India who use systematic sampling methodology which is inter-temporally consistent and compatible with international standards. Processing conducted both by registered factories and by unregistered manufacturing units as defined in section 4.2 and elaborated in Appendix A4.2.3 and A4.2.4 will be addressed. Considerable attention will be paid to the quality of data used. Validation based on cross-checking with information collected by other official departments will be part of the process. Appropriate revisions or corrections are made when felt necessary and wherever support is available from the alternate sources.

Broadly three issues needed to be resolved. They relate to the (i) specification of agricultural products to be considered as inputs for processing, (ii) the definition of processing and (iii) the coverage of processing activities by this definition. Specifications, definitions and data availability merited significant consideration while developing the methodology and selecting deciding the coverage. In limited cases, intuitive judgement and judgement based projections are unavoidable due to paucity of data.

4.2. Data issues

The primary requirements are for data on (i) quantities of inputs that are produced in Indian agriculture and processed in industry, (ii) production of the same items in Indian agriculture and also (iii) prices of the same items. The sources of data are Annual Survey of Industries (ASI) for agro-input data from organized (registered) factories and National Sample Survey (NSS) for agro-input data from unorganized enterprises outside the factory sector. Production and price data of the items are taken from the Ministry of Agriculture (MOA) sources appearing either as printed publications or in electronic websites.

Since our specific interest concentrates on items of agricultural origin, the relevant ASICC code (2004-05) varies from 11101 to 16000. Although food processing activities mostly fall under 2 digit NIC code 15 we did not confine our activity coverage and our domain is inclusive of all other activities. The details on the data sources and the protocols followed are reproduced in Appendix Table A4.1. As mentioned already, validation of the data is treated with utmost seriousness. Because the reliability of certain data contained in the ASI and NSSO databases has not been beyond questioning, support from data published by the Ministry of Agriculture was taken.

4.2.1. Period of analysis

Our period of interest is for the most recent time period as permitted by data availability. The latest data reported both from ASI and NSS is for 2010-11. However while the ASI data came in our possession only recently, the NSS data could not be analysed for the purpose in hand as the coding of items was not available to identify the agricultural products that entered processing as inputs (Appendix A4.5). For the period 2003-04 to 2010-11 estimates of the extent of processing of agricultural products is worked out in respect of the select items mentioned in Table 4.3 for organised factories. Although the estimates do not bring out the full extent of processing both in the coverage of processors (excludes all unorganized units) and items, the relevance of the estimates lie both in the significance of the items covered for Indian agriculture and the

importance of the organized sector for its size, transparency, expanding status and its formal compliance to policy objectives.

4.2.2. Agro-Input Data

Annual Survey of Industries (ASI) is the major source of industrial statistics related to organizations registered as factories and the compiled data is published by Central Statistical Organization (CSO) operating under the Ministry of Statistics and Programme Implementation (MOSPI). Agro-processing in India is however done mostly (see chapter 3) by a very large number of small enterprises scattered over rural and urban India although their share in value generated is modest. These units are not registered under the Factories Act[1] of India and are often referred to as unregistered units. Data for these units is collected by means of sample surveys conducted by the National Sample Survey Organization (NSSO) and recorded in its periodic reports on the unorganized sector. In this report the factories are presumed to be in the 'organized sector' and the units not registered as factories in the 'unorganized sector'. The data is presented in both published and electronic forms by both agencies CSO and NSSO and we have made use of both forms of data.

In the CSO-ASI sources the data for 'materials consumed' clearly refers to 'indigenous items consumed' which indicates that supplies are only from domestic agricultural production. The same data on materials consumed by the relatively smaller units covered by the NSSO is presumed to be only indigenous in origin (possibly even locally sourced). Materials consumed cover only *purchased* (or self produced) inputs that feed into the processing industries, both registered and unregistered, from agriculture, linking the two sectors.

[1] Under the Factories Act 1948 a **Factory** means any premises including the precincts thereof (i) Wherein ten or more workers are working or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power or is ordinarily so carried on, or, (ii) Wherein twenty or more workers are working or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on without the aid of power or is ordinarily so carried on, but does not include a mine subject to the operation of the Mines Act, 1952, or a railway running shed.

Our reference period of interest is the decade of 2000s when more vigorous reforms were initiated in the food sector (most potently symbolised by the model APMC Act[2], circulated in 2003) but limited strongly by the availability of data. While the survey of registered units is conducted annually, NSSO conducts the relevant survey only at intervals with no particular and definite periodicity and so data on unorganized sector is sparser. The data on organized sector is also not without its limitations. This becomes clear when the unit level data from ASI and NSSO is subjected to scrutiny for inter-year consistency and also for consistency with the corresponding production data reported by the Ministry of Agriculture. Both data even if available, lack clarity on the unit of measurement. The period of analysis is 2003-04 to 2010-11 for the organised sector but covers only two years 2005-06 and 2010-11 for the unorganised sector and the entire economy (combined) sectors. Given the inadequacy of data in 2010-11 from NSSO, the data is generated by our own projections (see section 4.3.1).

4.2.3. Production data

The data on production used is published by the Department of Economics and Statistics of the Ministry of Agriculture in electronic form (MOA_d, website) or print (MOA_a, various, MOA_b, various). For our analysis the marketing year is treated as the year of processing. In other words, processing is presumed to be done with a year's lag after production of the input in agriculture. This presumption is an unavoidable simplification and obviously bypasses issues of carried over stocks, harvests in current period, long growing seasons and perennial production of some crops and the policy effects. It must be added that the validity of our estimates hinge critically on the quality of production data from the Ministry of Agriculture besides those from ASI and NSSO.

While production of food grains and oilseeds have been traditionally reported for a very long time, the reporting for most horticultural products and animal based products are a relatively recent initiative of National Horticulture Board (MOA_e, website, MOA_a, various). Thus the production data itself is in the process of evolvement at the current stage and the system of

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building the statistical database on agriculture and food processing is desirable to be an integrated exercise in coming times.

Data on meat is reported by the Ministry but for further disaggregation into beef, chicken, pork etc, recourse to FAO data (FAOSTAT, website) was an imperative. Further the data from industries is presented in categories live animals and meat while production data is found only as meat. Since living animals as stocks with farmers significantly differ conceptually from annual or seasonal production of crops, the production of live animals is not defined. The animal stock is also meant for other multifarious functions such as for farm energy, draught, milk production, chemical industries and meat production is arguably a minor motivation in India's cultural background. We assume that the amount offered only for meat production purposes, which in turn diminish the standing stock (slaughtered for various purposes) with user industries, constitutes the production of live animals. This in turn implies that the total purchased amount is tautologically equal to their production.

For the purpose of analysis, a concept of Net production is visualised as a reference bench mark against which processing is assessed.

Net production = Production – Wastage – Seed – Feed…… 4.1

Where, Production is as reported by MOA; wastage is the total post harvest losses estimated by CIPHET (see 4.2.5) seed and feed are farm level retentions as advised by MOA. The allowances used for analysis are listed in Appendix 4.

4.2.4. Price data

Data on wholesale prices for dominant crops are reported by major markets or *'mandis'* by the Ministry of Agriculture (MOA_c, various). These *mandis* are located in various states. We computed national level annual wholesale prices as the average of the reported *mandi* level prices for the same reference marketing year, taking care of excluding inconsistencies that can be

reflective of differences of variety of reporting error. In a few cases like mango and papaya we had to resort to data imputed by the Food and Agricultural Organization of the UN (FAOSTAT, website). Overall, the price data is available only for select crops depending on their dominant presence in the market and the data reporting system of the government .The official data unfortunately, does not cover all items that are reported as inputs in industry.

The Wholesale price data so obtained is useful for both validating the prices imputed from ASI and NSSO data on purchases of inputs and for arriving at robust estimates of quantities purchased by the factory sector for processing. The insufficiency of price data is a serious limitation in our exercise requiring us to resort to assumptions for overcoming the constraint.

4.2.5. Data on Post harvest losses (PHL) and its background

Increasing the production and reducing the post production losses are both means of increasing supply and thus, although the former has enjoyed greater significance in agricultural planning, it is increasingly realized that the latter path too merits comparable attention. The wastage is assumed to be exogenous to the product transformation process so that the extent of processing can be computed only with reference to the amount available and not produced in the economy.

Losses occur at various stages in the supply chain. During production and while the plant is standing on field they need protection from pests, diseases and natural calamities. Losses are involved when the product undergoes a series of post harvest operations sorting, grading, processing, transportation and storage. Finally losses also occur at retail level and after purchase by consumers. To measure supply and to curtail losses it is important to have information on the extent of losses in different stages. Scientific studies appearing in journals do give an indication of the extent but such studies have the limitation of being confined to laboratories, experiment fields or at best to certain regions. Anchored on diverse procedures, they only crude approximate for national level figures and are not comparable among themselves.

In early 1960s Government of India appointed a committee under the Chairmanship of Dr G. V. Panse of IASRI to assess PHL of foodgrains. A first of its kind, the study collected considerable information on the magnitude of losses from various government agencies and research institutions. Meanwhile the FAO also came out with a manual on Assessment and Collection of data on Post harvest food grain losses in 1980 (FAO, 1980) for developing countries to encourage generation of uniform and systematic methodology for reliable data. The manual provided in detail the methodology for data collection on the extent of PHL.

Directorate of Marketing and Inspection (DMI), Ministry of Rural Development conducted a large scale sample survey for estimation of marketable surplus and PHL of foodgrains in 1996-97 (DMI, 2005). The study was based on data collected by enquiry only. The PHL covered only losses at the producer's level and market channels are not covered. The estimates are only for cereals and pulses even though horticultural crops and non-crop products of agriculture are gaining importance. This was a significant lacuna in this initiative. These crops are highly perishable especially in hot and humid conditions so that PHL of such products are like to be considerable. Fishery provides an extensive employment opportunity and fish is a cheap source of nutrition for people but discards of small fish, improper handling after catch, insufficient icing, inefficient containers, transport delay, physical damage and biochemical changes cause PHL. Marine fish is lost onboard the craft, discards of juvenile and low value fish, improper handling and infrastructure add to the loss. Starting from a backyard activity, poultry farming is far more commercialized today but the lack of coldchains and disorganized marketing cause damage to shells of eggs, live weight shrinkage, mortality, downgrading of carcasses. Bruises and injury are triggered by the distances required to be traveled because regional imbalance of production is marked. Studies on poultry losses are extensive in industrialized countries. Milk, another product from agriculture, is highly perishable and sold in small quantities by farmers dispersed in remote rural areas. Chilling facilities are scarce and some processing is essential adding to handling losses.

Due to the enormity of the problem, the Parliamentary Standing Committee on Agriculture (PSCA) again urged IASRI to collect authentic data on PHL of agricultural and allied sector produces on an all India basis. More recently the Central Institute of Post-Harvest Engineering

and Technology (CIPHET, 2010) published estimates of PHL in the recent context with a far larger coverage than the previous DMI study and the estimates are as expected at variance with the earlier results. CIPHET considered quantitative losses only and not qualitative aspects (food value, good will, seed vigour, quality). A simple definition of loss is reduction in the weight of edible grain available for human consumption (not drying), implying that quantitative loss renders material unfit for human consumption. Using verbal enquiry and actual observation as methods and covering stages at harvesting-cutting of standing crop, plucking fruits, uprooting, catch, milking, slaughter, collection-stocking, stacking, removing green leaves, separation from net, filling cans, Sorting and grading-, Winnowing/cleaning, Drying, Packaging, Transportation, Storage at farm level, godown/warehouse, storage at wholesale market level, retail level, processing unit PHL was estimated. Moisture loss during drying was not treated as loss.

The surveys on PHL also yield useful information on farmer's disposition of different products. DMI since its inception in 1935 is engaged in conducting surveys of marketing of agricultural commodities. The nation wide survey done for estimation of marketable surplus and PHL 1996-97, 1997-98, 1998-99 covered 25 states, 100 districts 15000 cultivators . The methodology was approved by a technical committee in consultation with IASRI. The survey found that of the paddy produced in the country, family consumption was 26.1%, labour consumption 2.22, farm purchases 5.4%, seed 1.8%, feed 0.18%, payment in cash and kind was 1.5%. The marketed amount was 51.97% of which direct to consumers sales were 3.6%, sales through cooperative 3.9%, to FCI 9.7%, 65% sales within villages. Though the marketed surplus was 51.97%, marketable surplus was higher at 55.48% indicating buy-backs and the PHL was 2.71%. Of wheat, family consumption 27.5%, seed 3.3%, feed 1.8%, marketable surplus 57.36%, marketed surplus 53.81% and PHL 1.79%. Of Jowar, family 34.2% marketed 39.72%, marketable 32.51%, PHL 2.2%. Bajra, marketable 48.98%, marketed 45.44%, PHL 1.89%. Maize, marketable 48.34% marketed 46.25%, PHL 2.45%. A Pilot methodological Survey was also conducted by IASRI in 1973-74 (IASRI, 1975). These findings have proved useful for validation of our results.

CIPHET's more recent comprehensive nationwide quantitative effort at assessment of harvest and post harvest losses was in respect of not only foodgrains including cereals and pulses, but also oilseeds, fruits, vegetables, sugarcane, spices, plantation crops, milk, meat, fish, poultry

meat and egg. Uniform procedure was used, supervised by experts from 31 All India Coordinated Research Project (AICRP) on post harvest techniques of the ICAR. The procedure was devised with the help of IASRI. Losses covered harvesting, collection, thrashing, grading, sorting, transporting making up the losses in 'farm operations' and storage (farm level, godown, cold storage, whole seller, retailer and processor). Estimates obtained both through enquiry and observations were combined. The study found that between 3.9% (sorghum) and 6% (wheat) of produce of major cereals accounting 94% of national cereal product was lost. Corresponding losses were of the order 2.8 to 10.1% for oilseeds and 4.3 to 6.1% for pulses. Farm operations constituted two third of the total losses. PHL for fruits and vegetables were higher at 5.8 to 18%, and was 6.9% for inland fish, 0.8% for milk, 2.3% for meat and 3.7% for poultry. The PHL estimated by DMI and CIPHET for select crops are presented in summary form in Table 4.1 and suggest concordance. There is also considerable literature on the subject summarized in CIPHET. Losses of foodgrains due to rats (Diwakar et al., 1983), losses at intermediary levels and in warehouses (Narain and Khosla, 1984) and losses estimated from pilot studies were reported (Bathla et al 2005, Wanjari et al, 2005) are reported. CIPHET's estimate for the proportion retained by farmers at 33.2% for paddy and 37.8% for wheat appears lower compared to the earlier estimates by DMI perhaps indicating more market orientation.

Table 4.1: All India Marketable Surplus, Marketed Surplus and PHL of certain major foodgrains

Crop	Production (mill tones)		Marketed Surplus (%)		PHL[@] (%)	PHL-CIPHET farm level * (%)	PHL-CIPHET Over-all loss ** (%)
Source	MOA	MOA	DMI	CIPHET	DMI	CIPHET	
Year	1998-99	2007-08	1998-99	2007-08	1998-99	2007-08	
Paddy	129.1	145.0	52.0	66.8	2.7	3.9	5.2
Wheat	71.3	78.6	53.8	62.2	1.8	4.7	6.0
Maize	11.2	18.9	46.3	76.6	2.5	2.8	4.1
Bajra	6.9	9.9	45.4	60.8	1.9	3.8	4.8
Black Gram (urad)	1.3	-	63.5	49.2	2.5	5.0	6.1
Green Gram (moong)	1.2	-	59.6	66.8	2.4	4.1	5.5

Note: @The PHL covered only losses at the producer's level only.* Farm level PHL includes harvesting, collection, threshing, sorting/ grading, winnowing/cleaning, drying, packaging, and transportation. ** Overall loss includes farm level PHL in addition to farm level storage, go-down/ warehouse/ cold storage, wholesaler level storage, retailer level storage and processing unit level storage losses. Sources: DMI (2005), CIPHET (2010).

4.2.6. Validating Quantity data from Organized sector

ASI collects data on both the quantity and the purchase value of various inputs consumed by the industries as inputs. The value of output and input reported by ASI has been subjected to larger academic review as large volumes of literature on industrial performance (Goldar, 2004, Neogi and Ghosh, 1998) grew out of this data. Deflating the purchase value of inputs by the quantities we can derive implicit prices of inputs consumed based on ASI data. The imputed price signifies the average price at which the factories procure the different agro-inputs. We compare the price data so imputed with the Wholesale Price data as reported by the Ministry of Agriculture separately. Prices imputed from ASI data (wherever meaningful) and the officially reported Wholesale prices of items are reported together in Appendix Table A5.1(a) for comparison to assess the reliability of the quantity data.. By and large, barring discrepancies the wholesale price data sourced from Ministry of Agriculture seems representative of the ASI imputed price.

Although the two series are largely convergent, on close inspection, there arises instances of severe mismatches from 2005-06 onwards, reflecting either on the quality of data or on the reliability of the units of measurement supplied with the data on a time series basis. It was felt, and further recommended by CSO, that the value data from ASI rather than the quantity data should be used with confidence. Support from Ministry of Agriculture reported data on Wholesale prices would help in arriving at imputed quantities

While we do expect that the two sets of prices, i.e, those imputed from ASI data and those reported by MOA as WSP, would not differ significantly given that processors would rationally purchase at wholesale rates, there are reasons to expect variations also. Firstly, processing companies in reality buy from different sources or from different points in the supply chains rather than only from the official wholesale markets. The sellers could even be retailing vendors and are more likely to be certain middlemen or organized agencies operating in the chains. With liberalization direct purchase from farmers is also becoming common in many states (Rao and Jeelani, 2011, Singh et. al, 2011, Kakaty and Borah, 2011)

Second, in many cases there are contracts involved in the transactions undertaken by processors in procuring raw materials and prices can be pre-decided reflecting some earlier prevailing market prices and factors like the degree of bulk buying advantage, bargaining strengths. The prices are also expected to be sensitive to the quality required. Contract farming in official form is also gaining currency in some of the northern states so that farmers sell to processors or a middleman on a shorter than usual supply chain on contract. All this is more relevant in the case of horticultural crops.

Thirdly, the average wholesale prices hide regional variation and more significantly quality differences that impact on prices. Fruits and vegetables procured for processing are usually of certain specific grades while the remaining products are sold to final customer to be consumed fresh.

However, despite the above reasons for caution, by and large, the procurement price of the organized processors cannot be expected to depart significantly from Wholesale market rates. They are likely to be moderately less than the Wholesale prices given the incentive of the processor to buy cheap by shortening the supply chain, buying in bulk or by procuring from producing areas with their logistical facilities but the quality standards demanded may exert a pressure on the reverse direction too.

4.2.7. Validating Quantity data collected from Unorganized sector 2005-06

Data on both quantity and value of different items collected by the NSSO (unit level data available on CD) enjoy a high degree of credibility evident from their frequent use in research. There seemed to be no obvious for doubting their validity to start with but validation exercises conducted on data for 2005-06 pointed out certain discrepancies in NSSO data as well and called for a way of resolution. The method used in the case of the Organized sector is however not intuitively justifiable.

On closer inspection the source of the problem appeared to be in the codes of units for measurement. The quantities are declared by different producing units in multiple units of measurement as in ASI data. A majority of the units are acceptable for use (such as 2-kilograms, 3-tonnes, 1-numbers) but not all of them can be expressed in any standard measurement of weight, tonnes being our choice of a uniform unit in the computations. For lack of reasonable conversion rates a few units coded even appear to be irrelevant or erroneous (say, metre to measure milk). A presumption that all such invalid units of measurement should actually be tonnes can impart inaccuracy though minor in most cases. An alternative solution of taking prices from an extraneous source to get the derived quantity as in the case of the organized sector could be no better because the results could be dubious when the informal units are likely to buy from local sources or in non-market transactions in which case the prices paid may have little to do with wholesale market prices. A priori the prices paid by the unorganized unit may be expected to be lower than the WSP due to the method of sourcing, possible minimization of transport cost and agent's commissions but in limited cases the accessibility and bargaining strength enjoyed could be far less and they may end up paying more than the market rate.

As a resolution we take the method of deflating the value data to arrive at the derived quantity but generate the price data from the data itself. We decompose the quantity data by the units they are reported in and take the most recurring as well as acceptable unit for agricultural items which happens to be kilogram (kg) in all cases and dividing the total value of input used by enterprises reporting in kg by the sum of their reported quantity we compute an imputed price for the item. We treat this imputed average price of a subset of the reporting enterprises in the unorganized sector as the representative price facing all such units. The prices imputed by the two methods are compared to WSP reported by the MOA in Table A5.1(b).

4.2.8. Net supply available in the market

The extent of processing can be assessed only in reference to production in agriculture in the previous year (see table A5.7). Not all produced amount is available for processing. Part of the product is retained by the farmer for use as seed or feed and is not available for commercial use.

A considerable part of the product is wasted as in harvest, storage or transit and does not contribute to supply. We have assumed the wastage proportion to be as estimated by CIPHET (2010) as discussed in section 4.2.5.

For livestock products there are further complications as ASI reports purchase of inputs as live animals and meat while the Ministry reports only meat products and the data protocol is not clearly specified. The focussed study requires conversion of numbers to weights using representative average weights of live animals, assumptions regarding prices of animal meat and allowances for inedible parts as discussed in Appendix 4.4.1. For live animals production is assumed to be the animals actually offered. Net supply (or Net production) of vegetable products is arrived at by subtracting the allowances for seed feed wastage and inedible parts as and when required. Seed and feed allowances are decided based on knowledge obtained from the Ministry of Agriculture. Details of the methods and assumptions are discussed in Appendix 4.4.

4.3. Derived quantity and Extent of Processing

A derived quantity of an input is obtained by the formula

Quantity derived= Value/ Price…4.2

Where quantity derived expressed as the ratio of the value of inputs consumed (reported in ASI and NSS data) to the representative price such that

(A) When processors are in the organized factory sector

4.2 (a) Price= Wholesale price of the same item reported officially by the MOA

and

(B) When processors are in the unorganized sector

4.2 (b) Price= IMPP or Imputed price from NSSO data

Where

$$\textbf{4.2 (c) IMPP} = \sum \textbf{Value}_i / \sum \textbf{Quantity}_i$$

With subscript i being all the enterprises in NSS data that report quantity in kg.

The extent of processing is calculated as quantity processed divided by the quantity produced in agriculture with due allowances and is expressed in percentage.

$$\textbf{EPA= Input Consumed/Net Production… 4.3}$$

Where Input Consumed is the quantity of input of the item (or items in the group) and net Production is the farm production of the same item or items in the group adjusted for supply chain losses in wastage and farm level allocations for seed and feed as given in equation 4.1. The remaining portion is left for consumer's disposal (consumption in any form or other uses), export in raw form and for storage to be carried over if possible.

4.3.1. Projections for Unorganized sector in 2010-11

The absence of codes to identify the agro-items used as inputs for unorganized processing units in the NSSO data comes in the way of making estimation for the latest year for which data is available. The ASI data only helps to provide a partial picture. To make crude estimates for the year, projections are attempted using certain assumptions which are seen to be reasonable. Different assumptions can generate alternate estimates and the confidence that can be placed on any of the assumption will only be determined by the available a priori information and perceptions.

We tracked the performance of the food processing industries in terms of various summary indicators categorized by two broad sectors loosely termed the organized and unorganized sectors in Chapter 3. Although the indicators are with respect to aggregates rather than to sub-

sectors this is the information base for making the projection besides the estimates of the quantities processed worked out for 2005-06. Four alternative projections are made linked to specific assumptions about the possible trajectory of the scale units measured by material input consumption that could closely approximate the outputs per unit also if we assume a fixed coefficient in production relation.

(i) The first option could be to assume that between the years 2005-06 and 2010-11 the quantity processed in the unorganized sector grew by the same percentage rate (g_0) as in the organized sector. However, in chapter 3, table 3.2 we found that between these two years the total number of units in the unorganized sector fell by 13.89% from 2.6 million units to 2.2 million whereas the number of enterprises increased from 23.7 thousand to 30.3 thousand i.e., by 27.5% in the registered factories. Clearly, this (g_0) is a strong assumption at the average, demanding that the scale of production has grown manifold. In the meantime the employment rose by 19% and fell by 8% in the organized sector and the unorganized sector respectively. The material consumed is available in value terms and cannot be compared over time due to price increases. The average employment of workers also decreased on the average in unorganized unit from 2.2 to 2.1. The same in the organized unit also fell from 59 to 55. Although not conclusive in any sense, the assumption of a large increase in the scale of activity of the unorganized unit seems unrealistic. It may be kept in mind that in reality the growth rates of the indicators (number, size, quantity of inputs) would differ across items that are processed as opposed to the average figures being considered, so rejection of the assumption is not foregone.

(ii) A more moderate increase in the scale can be assumed so as to balance the fall in the number of units, so that there is no growth in the quantity of materials consumed in the unorganized sector giving a growth rate over 2005-06 of $g_1=0$ for each sub-sector. In other words, the total quantity of inputs used in the unorganized units remains same in 2010-11 as in 2005-06.

(iii) A further moderate increase in the average scale of unit by 10% would allow us a small fall in the quantity of material inputs where g_2 is -3.89% uniform across sub-sectors which is the

percentage decrease in the total number of units (13.89%) less the assumed increase in scale (10%).

(iv) Finally, if we assume that the scale remains unchanged over time, in which case, the material input consumed would also fall and **g_3 = -13.89%,** the rate at which the number of units decreased (g_3)

This procedure gives four possible assumption and the corresponding estimates offering varying levels of confidence. Although it is not easy to make a decision either at the average level or for individual item-cases, to create a choice of flexibility we report the medium values of estimate of g_1 along with the maximum and minimum. All the alternative estimates are reported in the appendix leading to corresponding estimates for the total of the two sectors.

4.4. Definition of Agro-processing

Agro-processing in this exercise is conceptualized as commercial activities in which the agro-products enter as purchased inputs and the processor is seen to sell them in a different (value-added) form. In other words, processing is seen as a manufacturing activity and not as a service providing activity. For millers who provide say grain milling services to consumers or other entities, the raw grain (paddy, wheat, oilseed) does not appear as an input and grains are not reported as purchased materials in their accounts.

Various groups of commodities undergo alterations of form, quality, composition and presentation between their natal stage in farms and final consumption through a range of activities occurring often in succession. In principle both to avoid triviality and to prevent over-counting, not all amendments should be taken into account for measuring the extent of processing. For the specification of food processing, there is unfortunately very little support from the literature to this effect or anchorage from national or international guidelines. Indeed, trade classification even at the international level remains highly inadequate (FAO, 1986, 1996).

It is fairly obvious that nearly all agro-products need at least some minimal processing before they become fit for consumption. Some of the preliminary procedures are conducted at the farm level, often integrated with harvesting or in the proximity of the farm. A second set of procedures transpire only at a more downstream level. The first set of procedures can be simple and include threshing either with feet or with machines to enable separation of grains from the adjoining vegetation as well as cleaning, shredding and sorting and there is nearly no data protocol for recording the activities systematically. These minor transformation necessitated for rendering the farm product marketable are not included as food processing although such a simplification may be argued against. More radical transformations occurring at downstream levels can be facilitated with technology but even these activities vary in complexity.

Among the processing activities done commercially outside the farm, some are primary in nature involving milling, crushing, grinding and squashing of grains, oilseeds and sugarcane. While much of these primary transformation can be done by smaller enterprises with relatively simple, uniform and easily accessible mechanization facility, more sophisticated versions of the some of processing are likely to be observed more commonly in organized factories owned by larger companies. Here these activities are more frequently enabled not only by technology of higher degrees of complexity but supplemented by knowledge of hygiene, protocols, branding (product differencing) and packaging associated with managerial practices[3]. Thus agro-processing presents itself as a range of layered activities moving from the simple to the complex and growing in knowledge intensity. To make matters more complex some of these activities, whether conducted with traditional or modern technology, are essential amounting to triviality, therefore, distinguishing the minimal processing from substantial processing and even value addition is not easy.

Discussion at various forums and consultations with experts strengthened our conceptualization of processing as 'alteration by heat, pressure, chemicals, or freezing temperatures[4] (see Appendix

[3]For example, cereals like rice and spices such as turmeric may be produced in small informal units and sold loose at retail or are manufactured with machines in sanitised environment and sold in packets in higher end retail stores.
[4]USDA is known to publish acreage and production data on fresh and processing, generally by defining them as:

A4.6). However, limitations of data on various stages of product transformation and varying nature, integration and complexity associated with any transformation make the specification of food processing far from simple and clear specifications are necessary. Primary processing that are largely essential for consumption are treated separately as 'basic processing' but not counted as food processing despite the possibility that these activities may also be technologically modern and independent of other subsequent transformations.

4.4.1 Basic processing as Manufacturing

The concept of basic processing though not considered in this study as constituent of food processing, also needs to be spelt out separately. This concept applies only to a few of the select items for which this primary processing is largely essential. Thus not all primary processing is basic processing. However, even the raw items that require basic processing for human consumption can have other uses, mostly for non-food purposes. Raw agro products like grains are used for making animal feed, generating energy, manufacturing craft, and useful household items like mats and brooms and as subsidiary inputs in other manufacturing processes.

On preliminary consideration, the extent of basic processing of raw items like unmilled grains is expected to be 100% and constitute triviality. In practice however this is not the case because not all of the basic processing occurs as commercial manufacturing, an activity in which conceptually the raw agro-products are required to be purchased as inputs. This acquisition happens in a limited number of transactions for the following reasons.

(i) Fresh: if it is sold to the consumer in an unaltered state. Lettuce that is picked, shredded, and bagged in the field is considered fresh.
(ii) Processing: if it is sold to the consumer after it has been altered by heat, pressure, chemicals (like pickling), or freezing temperatures.

Sarah Hoffman of USDA is thanked for the clarity she provided on this complex issue.

Firstly, farmers retain a substantial part of those products (say, wheat) themselves for home consumption in which case the farmer is the consumer. In India a large part of the grain is sold in unmilled form to the government and other agencies to be distributed f or stored for food security. Farmers may also sell directly to rural consumers who undertake the task of primary processing. Consumers are known to purchase both the semi-processed (atta) product and the raw products (wheat) from wholesalers, retailers and public distribution outlets. In all these cases where the farmer is selling to consumers or to agencies designated for public distribution, the millers provide 'basic' processing services (converting wheat to atta using a machine) at a cost to the consumer The cost of the raw product (wheat) does not appear as a cost to the miller unlike in the case when the miller or a processor buys the grain as a raw material. The raw product (wheat) is a consumer good and not an intermediate input.

Thus although in principle a large part, ideally 100%, of these agro-products would undergo milling, we report only the estimate of basic processing only as a manufacturing activity. The remaining part of the produce would be milled in the service sector and not covered in our estimate.

4.5. Hierarchies in Food processing

By our much pruned specification some activities appear too basic to merit special consideration as agro-processing. A solution can can have been to take out all primary activities like milling, crushing and slaughtering from the ambit of processing and designate the primarily processed products (all milled products) rather than the basic raw items (milled and unmilled products) as inputs. Alternatively, one may consider both basic items and primarily processed items so that processing at the basic level and the higher level are both taken into account. The decision would depend on a priori knowledge of the nature of the item, its processing and the social culture of consumption.

Figures 4.1 (a) to 4.1 (d) demonstrate the value addition chains that qualify consumption practices of four common products in India. In the case of rice, paddy is the basic item from

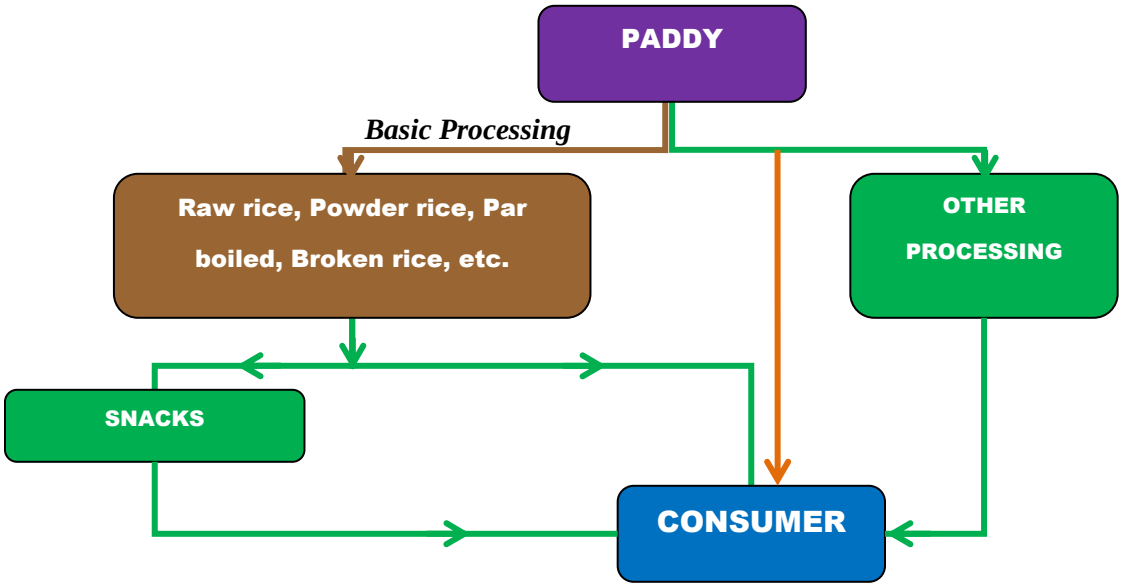
farm, consumed mostly as rice, milling can be perceived to be basic but a part of the raw paddy (Figure 4.1 (a)) may also be processed outside the rice industry. Similarly, raw wheat from the farm (Figure 4.1 (b)) is mostly milled (basic) into flour, *maida*, *atta* which can be cooked in the consumer's kitchen. Our interest is mostly on the part (rice, flour) that enters value addition (colour) chain to churn out consumer items like non-conventional energy, idly mix, bread, cake, biscuits and the likes. Consideration of the raw farm derived product will generate to us trivial knowledge while important information on the value addition to the milled product is lost.

In a dissimilar example of pulses, the primary processing is not essential as consumers do accept directly in their kitchens unmilled pulses whereas pulses can enter value addition in industry both in their milled and unmilled forms (Fig 4.1 (c)). Yet in another contrast, oilseeds, apart from being processed for non-food purposes (Figure 4.1 (d)) as manures or animal feed, can become inputs in their raw forms to other food items (such as snacks) but admittedly, a bulk of the oilseeds is certainly primarily processed in oil mills to edible oils and even the oils find alternate routes to reach consumers either directly for domestic cooking or via further commercial value addition as further refinement for consumer cooking and making other food products. Unlike for paddy and wheat, it is difficult to qualify primary activities (milling, crushing) in respect of pulses and oilseeds as basic processing.

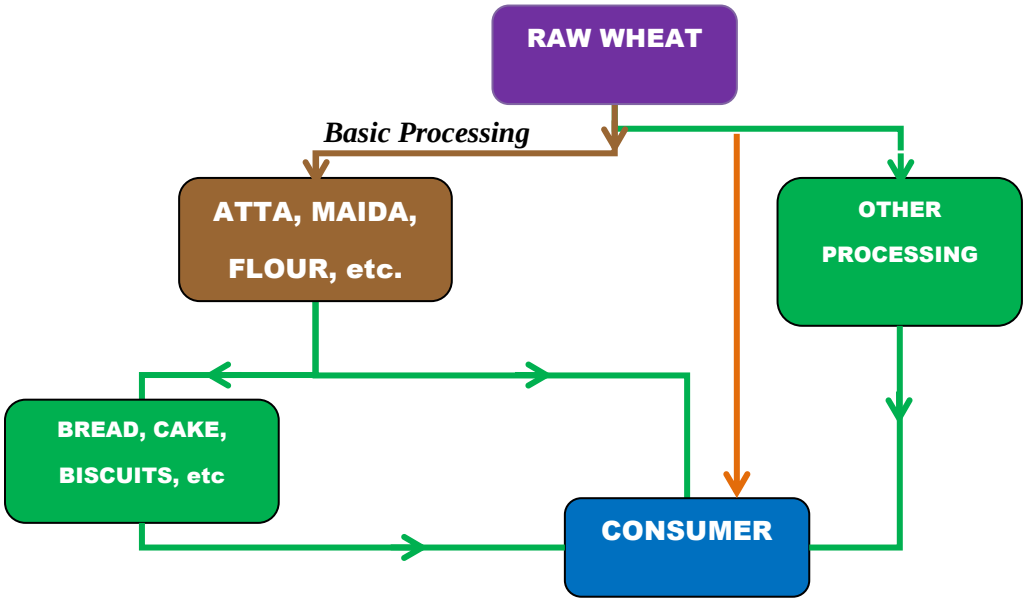
4.5.1. Food processing specified

Besides processing under the exhaustive umbrella of all agro-processing activities we also report limited estimates for the value added processing activities which constitute a sub-set of the exhaustive category. The specification of primary processing and value added processing are provided in Appendix Table A4.3.1 and A4.3.2 and Basic processing activities specified in Table A4.3.3. Agro-processing (food processing) category includes both primary and value added processing while estimates of basic processing for a few relevant items are furnished as a separate category.

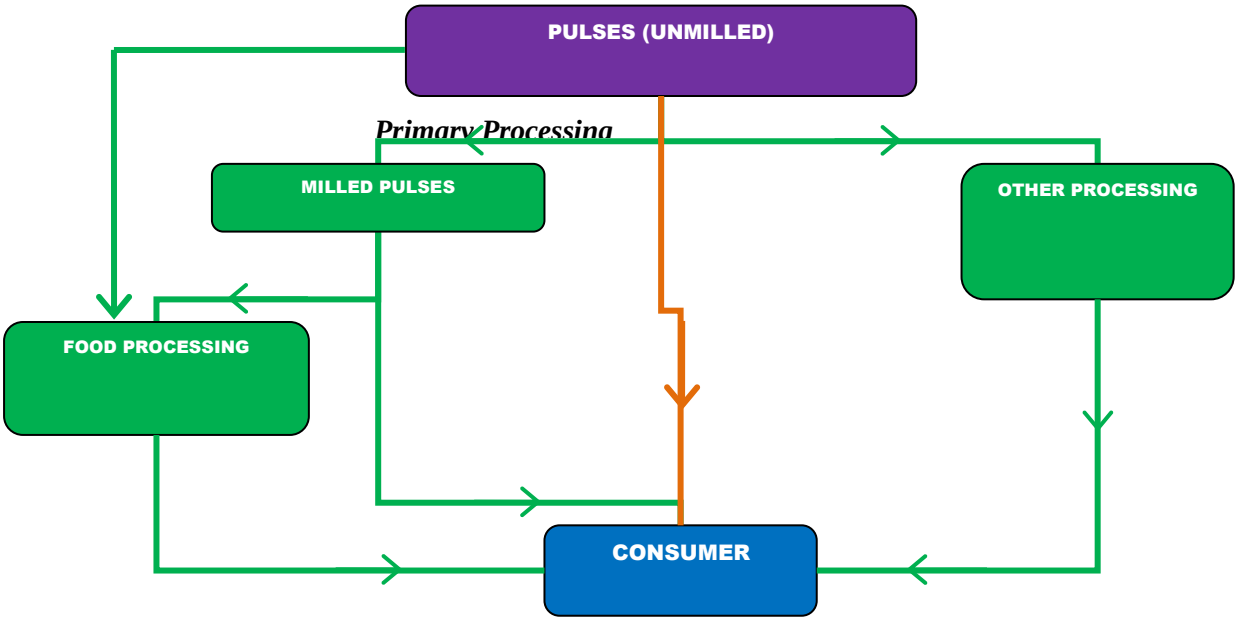
Figure 4.2 provides a generic flow diagram in the processing system. At what point in the chain, processing can be acknowledged to have commenced is a judgment based decision. Not all primary processing is basic as items are consumable with and without processing at that level. To do justice to the complexity, variety and our purpose we have attempted to distinguish basic (or nearly essential) processing from the rest of primary processing and also conceptualised food processing in two separate ways (i) all agro-processing (food and non-food output including primary processing excluding basic processing) and (ii) value added processing which goes beyond the primary processing in terms of sophistication and transformation (Figures 4.1). The implications obviously vary among items as illustrated below.



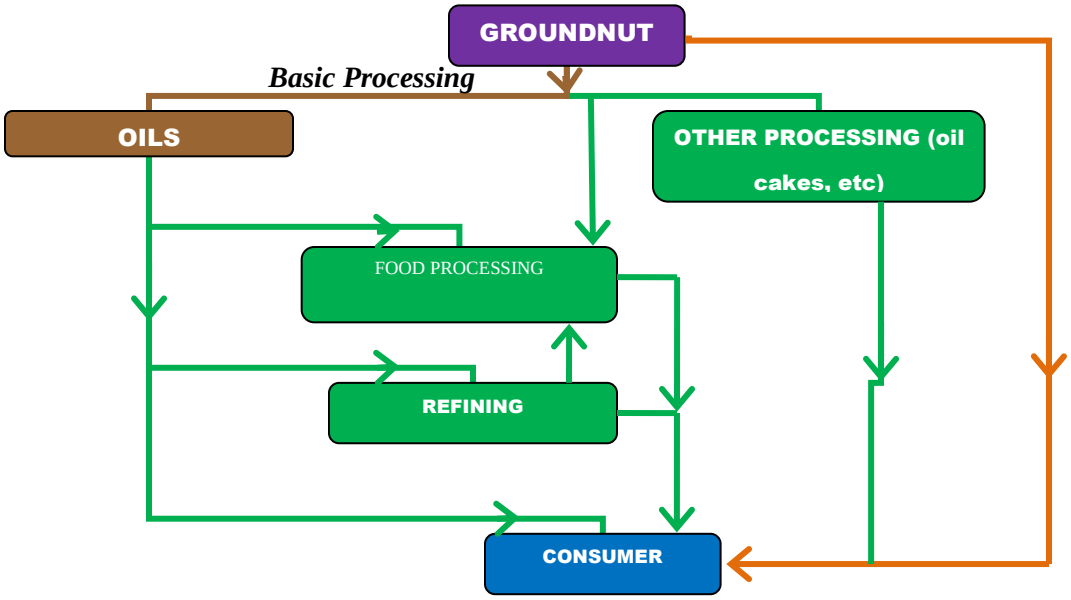
(a) Paddy



(b) Wheat



(c) Pulses



(d) Groundnut

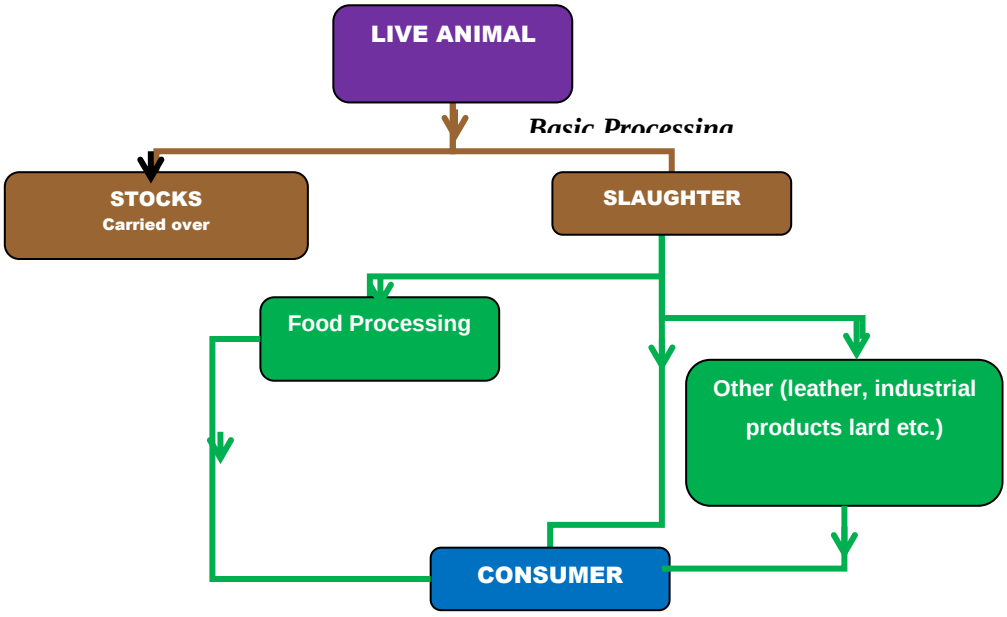


Figure 4.1 (e) Animal

Figure 4.1: Flow diagram for understanding basic processing, primary processing and value added processing of select products (Green: included in food processing, Brown: basic processing not included and Orange: direct purchase of raw product by consumer not included

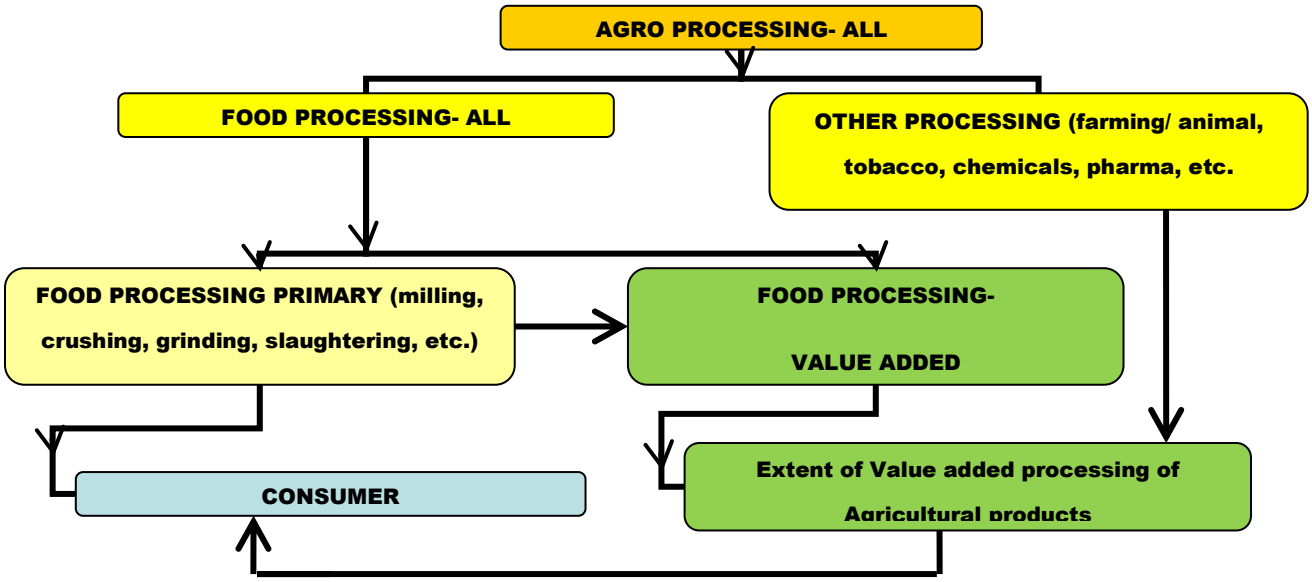


Figure 4.2: Flow diagram for understanding agro-processing of any item

4.5.2. Primary, Basic and Value added processing

Primary processing largely consists of milling of agro-products captured under the 3 digit NIC classification 153 (grain milling, starch products and animal feed) under NIC2004. Crushing of oilseeds to oils (NIC 2004- 1514) and milling of sugarcane to sugar (NIC 2004- 1542) and other cane products and grinding of spices (NIC 2004- 15495) are also such processes but under the umbrella 2 digit category NIC- 2004 of 15. Yet, excluding the whole category or even parts of the category is not the answer. There are also other activities such as traditional sun-drying of agro-products including fish (NIC 15121) and the familiar pasteurising of milk (NIC 15204) that can also arguably enter this category of primary processes under the current culture of Indian Consumers.

Slaughtering of animals is included under the umbrella NIC-2004 code of 151 and can arguably be treated as primary (or even basic) processing. Slaughtering is done both informally and in highly regulated commercial enterprises with modern technology and specified methods. Many of the processing activities identified as primary are done also with the aid of modern technology

and the product sold in hygienic, packaged and branded form. Given the heterogeneity of practices, the justification of treating all such processing activities basic or even primary is weak and making of the list of relevant activities for this purpose can be highly debatable.

While one may not dispute the argument in favour of the exclusion of activities identified as primary, in reality even this attribute does not apply to all the activities under this umbrella classification 153. That farm products even without these processes can be edible is a source of disturbance, but some activities go even beyond this primary threshold. Food items like breakfast cereals, roasted cereals (15316), prepared, blended, wet flour, dough for bread and cake (15317), readymade mixed powders like *idly, gulam jamun* (15318), manufacturing of *poha* and *muri* (15319) do not merit exclusion. Portraying higher levels of sophistication, they are hardly primary in character. So the exclusion of the whole group of activities is not warranted. We could identify these higher order activities only by taking account of higher digit NIC codes (4-

digit and 5 digit codes) and these activities are treated at par with other non-primary activities viewed concertedly as value added activities. The inclusion and exclusion in Value added food processing are detailed in Appendix Table A4.3.2.

Table 4.2: Dominant Primary Processing (including basic) Activities of Major Agricultural Items

Paddy	Rice Milling and grain milling activities
Milk	Manufacture of pasteurised milk
Wheat	Flour milling
Arhar	Dal milling
Sugarcane	Manufacture and refining of sugar, Khandsari sugar, gur.
Maize	Manufacture of poultry feeds and cattle feeds

Note: The activities have relatively higher shares among the above specified primary activities Source: Identified using ASI (2007-08) data.

4.6. Item Coverage

Our particular interest lies in essentially farm generated agricultural products that are used in some form as inputs in industry although the outcome of processing may or may not be food. Identification of these items is made using codes given as ASICC in various years but deciding

what items should be included in the coverage is not simple because of the two complexities namely (i) the need to separate basic processing to avoid triviality and (ii) differentiation between the primary and basic processing activities and between the primary processing and value added processing.

Inputs both as raw and primarily processed forms appear in the data on inputs. Most grains and pulses appear in milled and unmilled forms as inputs and even as seeds (presumably for seed industry or commercial farming). In the oil group, inputs appear as oilseeds for making oil, seeds and oilcakes and also as processed oils and further as refined oils. The multiple purposes make addition difficult and require caution. For items for which primary processing is basic processing special caution is required and it may be prudent to use the primary processed form into consideration as input.

Yet, exclusion of all unmilled products even for paddy and wheat would mean loss of information. This can happen in two ways. First the value addition process consumes inputs in the raw form such as in producing snack products (*namkeens)* from unmilled pulses, flaked cereals with fibre for breakfast (wheat or rice flakes) or making snack bars (chikkis) from oilseeds. The raw products may also be required for catalytic, subsidiary and facilitating purposes for processing other products including generation of energy.

A second possibility relates to consecutive stages of processing in the same firm when the raw product enters as input in the production process and comes out as a value added product from the same unit after a sequence of processing. Since the intermediate level input and outputs are not reported by ASI or NSSO, exclusion of the basic products would lead to under-evaluation of even value-addition processing.

Similar complexities can arise in the case of animal products because the ASI and NSSO report purchases of both live animals and meat as two different materials consumed but the live animal may be used both for producing consumable meat after primary processing (slaughtering) or for a sequence of processing leading to various consumable food and non-food products (Figure 4.1

(e)). To the extent that a unit produces meat not for sale to consumers after slaughtering but for meat to be used to further processed products, double counting cannot be ruled out if we combine both live animals and meats.

Addition of inputs both raw and primarily processed will lead to over-counting as certain units will use as inputs the primarily processed products that come out of other enterprises that in turn consume the raw forms of the same products as inputs. The over-counting will show up more starkly when both organized and unorganized sector units are included because primary processing is likely to be done in the unorganized sector from which the organized factories are likely to procure[5]. To address all this complexity, special focus is placed on certain selected items in subgroups of food processing.

4.6.1. Selected items and subgroups

ASI and NSS provide data for inputs used of a wide variety with a large coverage of agricultural products beyond the selected items listed in table 4.3. However for the organized sector the quantity processed can be worked out only for only those products for which price data is available (as seen in section 4.2.3) and in both cases production data from MOA is also required for estimation. There is also an ominous issue of over counting if all items reported as materials are covered and reported as integrated categories. We have therefore focussed on the few products constituted of items in five different groups not only guided by their importance in the market within the respective group but by the availability of data on prices and production. The estimates are made for 15 subgroups of items but within each subgroup the focus is on a few major selected items to be processed are also addressed to a certain extent.

[5] In emerging models the organized firm may be contracting to buy the raw input directly from the farm in which case the complication of double counting will not arise.

Table 4.3: Selected major Agricultural items and product groups consumed by processing industries (15 subsectors and 5 broad groups)

Subgroup		Agricultural products
Group 1: Animal Products		
1	Meat	Chicken, Bacon, Beef, Buffalo meat, Mutton, Poultry, veal meat
2	Fish	Inland fish: Pomphret, cattle fish, sardine, ribbon fish, hilsa, fish-not processed n.e.c **;** Marine fish: squid, lobsters, prawns, shrimps, crabs, mackerel, crustaceans-not processed n.e.c
3	Milk	Fresh milk (combination of buffalo milk, cattle milk, and milk n.e.c)
4	Eggs	Eggs all types
Group 2: Horticulture		
5	Fruits	Grapes, Mango (Fresh and Pulp), Papaya, Orange
6	Vegetables	Onion, Potato, Tapioca, Tomato, Chilli
7	Spices	Ginger, Garlic, Dry Chilli, Dhanya, Cumin seed, pepper, Turmeric, Cardamom
Group 3: Cereals and Pulses		
8	Pulses (Milled)	Arhar, Moong, masur, Gram, Urad
9	Coarse cereals (Milled)	Bajra, Jowar, Maize (fried seed-popcorn, corn flour, maize atta/ maida/sooji/flour, maize starch)
10	Rice (Milled)	Rice (par boiled, raw, basmati and broken)
11	Wheat (Milled)	Atta, Maida, Broken wheat
Group 4: Nuts and Oil		
12	Groundnut (excluding oilseeds)	Unshelled, Kernel, Shelled
13	Soyabean	
Group 5: Oil and Sugar		
14	Oil	Groundnut, Rapeseed, Mustard, Linseed
15	Sugar	Raw Sugar, Sugar candy, refined

Note: Items are selected on the basis of reliable data availability on prices and production and the significance of the items in Indian agriculture.

4.7. A Focussed study for the year 2005-06

Given that data for 2005-06 is available from both ASI and NSS both the organized and unorganized sector activities can be covered for the year to get an aggregate view of the food processing sector. The provision of NIC and ASICC codes for identification of activities and items respectively made the present analysis possible for the year. A focussed study covering a number of items raw, primary processed and semi processed and with two different specifications of processing namely (i) all agro-processing and (ii) value-added processing is done for this year.

The total value or quantity of items in any sub group (exhaustive) is worked out as a sum of all items reported as inputs in industry and outputs in agriculture transcending the selected items. The total value under the entire group reported by ASI is then deflated by the average price to get the derived total quantity of input in the subgroup (see 4.3.1). For this purpose a weighted average price has to be worked out. In the case of the selected products (Table 4.1) the task is fairly simple as the total quantity processed is represented by the sum of the derived quantities processed of selected individual items in the sub-groups. This is not possible for the entire sub-group.

As mentioned both ASI and NSSO reports for many items other than the items we selected. Some of the products in each sub-group are also reported in combined forms with the epithet n.e.c (not elsewhere classified). Thus in the fruit group, although separate estimates could not be worked out for fruit like pomegranate for want of price data, important items like apple are not separately reported at all. An attempt is made to go beyond the selected items in the exercise to include all the items in the group. Live animals are reported as inputs but may undergo primary processing (slaughtering) or further value addition. Live animals are treated separately from meat.

The total value and output in the subgroup is the sum of those of the selected items in the respective subgroups. The average price is also worked out in respect of the selected items in the subgroups as weighted average of the item prices. We have used the value shares within the subgroups in the organized sector as weights because the weights appeared to be representative on close inspection[6] of the data for both sectors and their processing activities.

The weighted average price of the selected items under any subgroup is assumed to be a proxy for the average of the price of the whole group. The assumption comes at the cost of some imprecision[7] but helps to overcome the unavailability of all price data. Unmilled cereals and

[6] It is observed that within any sub group, certain selected items are used more intensely as inputs in all activity categories in the organized and unorganized sectors.

[7] To the extent that the selected items are disproportionately less costly in the entire group, deflating by the weighted average price could result in overestimated quantities.

pulses groups, oils are among other items that are not considered in the select subgroups. The weighted average price of these subgroups is worked out in a manner analogous to the selected items in these cases. The weights are drawn from values shares within select items gram, arhar, masur and moong under unmilled pulses, groundnut, mustard, rapeseed and linseed under oils, unmilled cereals and groundnut, mustard and rapeseed under refined oils the subgroups how constitute a more extensive list of items. For unmilled cereals, only the value of inputs in valued added processing is considered for computing the weights as milling is only a basic operation.

For cereals, estimates are separately made for unmilled and milled inputs. For all grains and pulses input as seed is also subjected to estimation. Oilseeds are a source of complexity as oil milling has a primary character and at the same time some these have uses other than milling for oil. Oilseeds are also used for making oil cakes. We have made estimates for different oil product categories as oilseeds, seeds of oilseeds, oils, refined oils and oilcakes as reported in ASI and NSSO data. Similar estimates are made for sugarcane and allied sugar products. Soyabean is a versatile item, used as oilseeds, vegetables, pulses and snacks and hence is treated separately. The method of arriving at derived quantities is similar to the sub-groups analysed and the estimates hinge on the available data on certain items within the newer groups.

5. Estimates of the extent of Food Processing in India : Results

This chapter presents estimates of the extent of processing of specific food items and sub-groups of food items. Sections 5.2 to 5.6 consider only select items processed in the organized sector with an overview of the methodology followed by the estimates and their recent trends in Sections 5.3 and 5.4. The unorganized sector was introduced in sections 5.5 and 5.6 with a focus on the year 2005-06. In section 5.7 a more exhaustive coverage of the subgroups is made. The estimates are updated using projected quantities processed in the unorganized sector in 2010-11 and basic processing of raw items is also addressed in section 5.8. The user industries of the agro-items are identified in section 5.8.

5.2. Inclusions, Coverage and validation

We identify specific agricultural items of interest using ASICC or NPCMS codes as applicable. The items are raw products from farms in general but when primary processing is essential in character (see section 4.4.1), to exclude basic processing from the ambit, the selected items are agro-products that are already milled. Thus, milled paddy, milled wheat, oils, sugar and slaughtered animals (meat), all of which are primary processed, are considered for reporting instead of their original forms. The estimates are reported for the individual selected items as well as for their aggregates making up fifteen (15) broad sub-groups within five (5) major groups in agriculture (see table 4.3).

Due to data limitations, we report estimates of processing only in the organized sector for all the years 2003-04 through 2010-11 showing their trends in the decade. The choice of the starting year 2003-04 is justified by its watershed status marking reforms in agricultural marketing[1]. In the year 2005-06 a more focussed study covering also the unorganized sector was enabled by the

[1] The amended Agricultural Produce marketing Act (APMC) was circulated by the central Government as an advice to the states to amend their agricultural marketing regimes.

access to data generated by both ASI and the NSSO but derived quantities are used for estimation of the extent of processing as expounded in Appendix 4.6. The estimates relate to any stage of agro-processing besides those deemed as basic processing and cover both primary processing and value added processing as specified in Chapter 4. The first part of the results (section 5.3 to section 5.6) concentrates on a set of selected major items that are deemed to be important both in the production basket and for processing purposes and the required data on which is available.

5.2.1. Larger coverage

The estimates discussed up to section 5.6 obviously do not reflect the full extent of processing of agricultural products for want of price, processing and production data and the complexity of specification. For the year 2005-06 a more detailed analysis is however made. Firstly, separate estimates for value added processing of the items are reported in Appendix tables A5.4 in addition to the total estimate of agro-processing. Even where primary processing is of basic character, the raw items are also not overlooked and the estimates of the extent of only value added processing are reported (Table 5.3).

In reality, more items than covered are processed but lack data on prices, production or processed quantities at the item level makes it difficult to address. Estimates at the aggregate levels with exhaustive coverage of sub-groups transcending the select items can however be worked out if suitable assumptions are made. These estimates are reported in Table 5.3. Third, although apparently trivial, given the complexity of the market, basic processing as commercial manufacturing also merits consideration. We therefore report the extent basic processing of unmilled paddy, wheat, sugarcane and oilseeds in Table 5.4. Finally estimates for 2010-11 are based on projections made under specific assumptions (see Chapter 4).

5.2.2. Imputed prices and Wholesale prices of input items in processing industries

Tables A5.1 and A5.2 in Appendix 5 reveal that prices imputed from ASI data and the wholesale prices reported by the Ministry of Agriculture are comparable if not convergent in 2003-04 and 2004-05 but have diverged widely since 2005-06. From 2005-06 the data appears inconsistent and unacceptable in many cases going by a priori knowledge and reliability becomes suspect. In the case of NSSO data by and large the data seemed consistent with exogenous information but the interpretation was difficult in select cases as discussed in Chapter 4.2.7.

We have used for analysis the wholesale prices reported elsewhere as proxy for prices of inputs purchased in the organized sector instead of the imputed prices obtained from ASI data. For the unorganized sector, the averages of imputed prices of only a subset of the processing units covered by NSS are used as the proxy ensuring that the reporting satisfies our standard of confidence. The imputed prices from either data source, when reported reliably, signify the average price paid by the processor to purchase the respective inputs. To assess the credibility of the data used and to study the market advantages of different processors we compare the wholesale prices reported by the MOA and the imputed prices from ASI and NSS data for relevant years.

Based on the reliable quantity data for 2004-05 from ASI, it appears that the average prices paid by processors in the organized sector are lower than the wholesale prices in respect of rice, wheat, maize, pulses, oils, fruits, onion, tapioca, tomato, green, chilli, garlic, cardamom, milk, sugar, meat and egg (Table A5.1A). Prices of spices are comparable in most cases. Only the average imputed price from ASI data of bajra, garlic, potato and fish, both marine and inland are higher than the wholesale prices. Based on NSS data of the subset of processing units, the prices paid by the unorganized sector units are closer to the wholesale prices compared to those in the organized sector (Table A5.1B). While these imputed prices are marginally less in most cases, they exceed the wholesale prices in respect of wheat, maize, jowar, bajra, all spices and potato. The wholesale price of fresh milk at about Rs 16 per kg which is more than the imputed prices Rs 12 and Rs 10 obtained respectively from NSSO (2005-06) and ASI (2004-05). The analysis

by and large suggests that the processor in organized sector pays for inputs less owing to bulk buying, favourable contracts or other reasons while the unorganized sector unit does not enjoy any notable advantage on account of their presumed informal and local transactions.

5.3. Extent of processing in the organized sector: Selected major items

Data from ASI is analysed with respect to only select items under sub-groups for the years 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09 and 2009-10. The average of the seven years is plotted in Figure 5.1. Representative production data for the items under analysis are given for the years 2003-04, 2005-06 and 2010-11 in Table A5.7.

Among the select items soyabean is leading with nearly 30% of net products being processed followed by vegetable oil that is already primarily processed. Processing of coarse cereals, milk and fish also exceeds 10% of the net supply. Figure 5.1 only gives aggregative estimates that hide the variability within the sub-groups. In table A5.3 it is seen that processing level is low for all cereals, maize being the only major cereal item that is processed. Among the other sub-groups, urad and gram among pulses, grapes among fruits, tapioca among vegetables and cardamom, dry chilli and pepper among spices are processed in considerable degrees consistently. Among the animal products, about one tenth of fresh milk and fish are processed, meat processing has been only moderate but is showing signs of improvement. Only 2% of eggs produced are processed. The EPA of mustard oil is showing a rising trend from 2007-08.

Some degree of instability is also evident. In particular the extent of processing encountered a peak in 2007-08 in many cases, the cases of wheat, arhar, moong, oil (mostly groundnut), green chilli and meat being especially notable. In the case of soyabean the same year showed a dip in the statistics. The production of these crops was remarkably high in 2007-08 and supply could have been influenced by the anticipation. In 2010-11 the estimates declined in a number of cases such as maize, milk, inland fish, green chilli and some of the spices like cardamom.

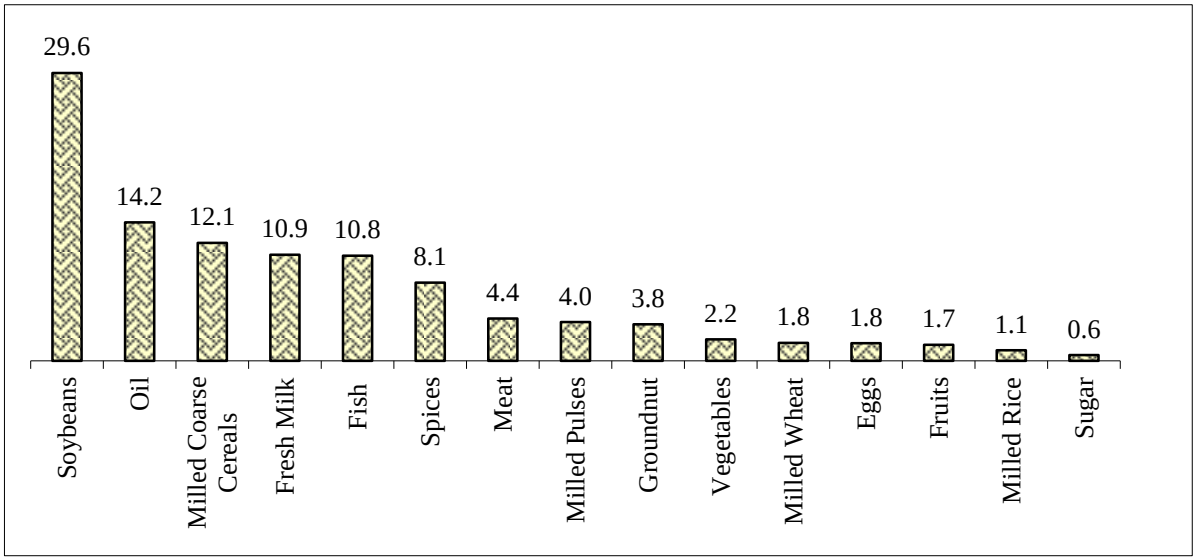


Figure 5.1: Extent of processing in Organized sector of selected items produced in Indian Agriculture in all Agro-Processing activities in 2000s (average of 2003-04 to 2009-10). For the selected items see Table 4.3. Source: Computed from ASI unit level and MOA data.

5.3.1 Representativeness of Selected Items in mixed sub-groups

As a percentage of production of the entire sub-group of items, the total production of the selected items varies from 38% of fruits to 86% of milled pulses (figure 5.2). Similarly in terms of processing, the selected items accounts for 45% of oil and 85% of milled pulses. It is interesting to note that the selected items account for 72% of processed items in the sub-group fruit and 82% in the sub-group vegetable but the same constitute only 38% and 52% of production in the subgroup respectively. Obviously there are many common fruits and vegetables that are not processed.

While the selected items of fruits and vegetables have a disproportionately higher share in processing relative to their share in the production basket, quite in contrast are subgroups like spices, pulses and coarse cereals in which the contributions to production and processing in the subgroup are similar. We may conclude that while the selected items are not highly representative of the Indian agricultural production basket in most cases, some of these items are more relevant for their amenability to processing.

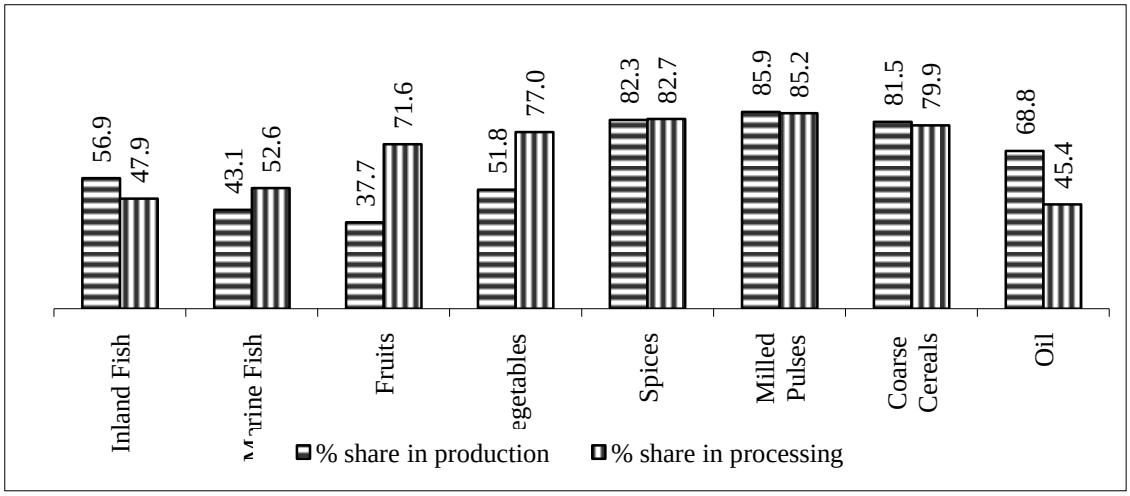


Figure 5.2: Percentage shares of selected items in the Gross production and the Quantity processed in Organized sector of respective sub-groups totals (average of years 2003-04 to 2009-10)
Source: Computed from ASI unit level data, MOA data.

5.4. Trends in food processing in the Organized sector: Selected major items

In the seven years beginning with 2003-04 the extent of processing (EPA) has shown a positive trend only in respect of sub-groups rice, pulses spices, meat, egg, fruits and sugar. Moreover, the estimates in respect of all these sub-groups except for soyabean indicate a low degree of processing (Table 5.1). The EPA of fresh Milk and Meat remained somewhere around 10% but it fell for Milk in the last sample year. Processing of milled rice, wheat and sugar have been less than 5%, being especially low for rice and sugar. The EPA remained within 10% for milled pulses, groundnut and spices and it was higher for coarse cereals and fish lying between 10% and 20%. The moderate instability in these estimates hampers generalization, especially notable in the cases of soyabean and edible oils.

Figures in 5.3 show plots of also the actual quantities processed expressed as indices (taking 2003-04 as the base year) of the same subgroups as aggregated measures. The rising tendency as noted in Table 5.1 is also implicit here but an impression of stagnation is suggested since 2007-

08 for a number of groups, vegetables, spices, milk and egg. In the case of milk the processing level has come down in 2010-11[2].

The case of edible oils deserved some exploration because the EPA hovering around 10% encountered a sudden peak in 2007-08 (51% from 15%). This could possibly be attributed to the fall in the production of edible oilseeds in the benchmark year 2006-07[3] indicating a base effect. On the contrary, the quantum and level of processing of rice, wheat and pulses are relatively high in this year and a higher share of indigenously produced edible oil may have been processed to meet the needs of the user industries in the face of the adversity[4]. Anticipation of a good harvest may have loomed. Refining the different edible oils is part of food processing[5] but Oil is also a necessary associate input in most other food processing activities. India imports half of its edible oil requirements to check prices that hurt consumers. Curiously, Figure 5.3 (d) shows also an upward movement of the quantity processed of the selected oils which include groundnut, rapeseed mustard and linseed oils.

[2] The estimate for 2010-11 which is 5.3% includes milk of cattle, buffalo and N.E.C. If only cattle and buffalo milk are taken (as is the 'concordance' with earlier year) the estimate is lower at 3.6%.

[3] Total oilseed production declined to 24 million tonnes in 2006-07 from 28 million tonnes in 2005-06 only to recover to 30 million tonnes in 2007-08

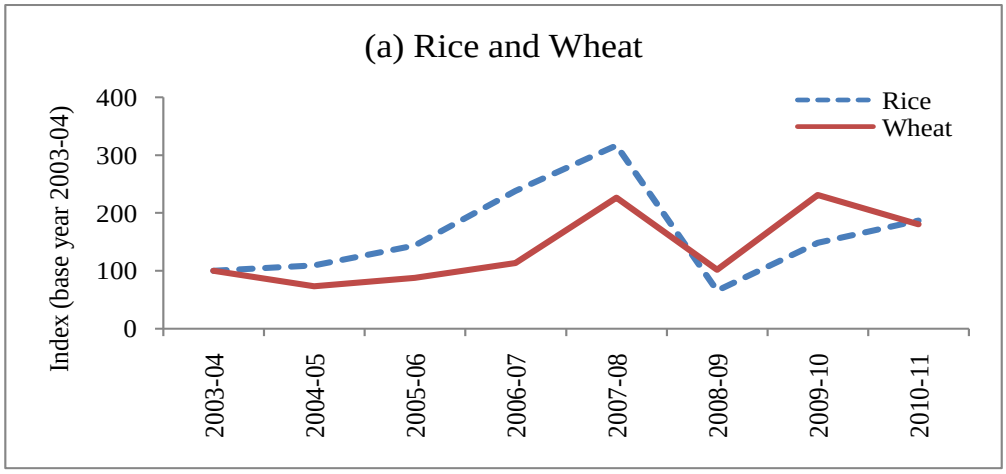
4 Most notably production of sunflower and groundnut oil declined

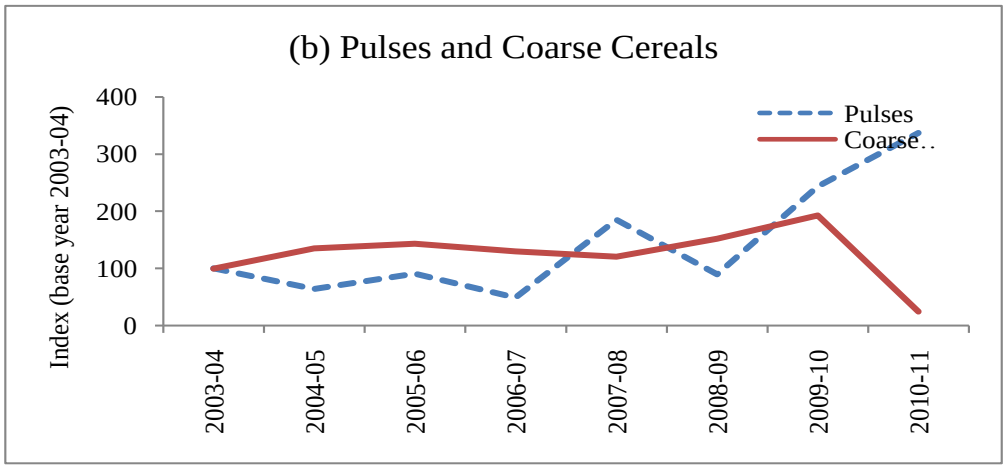
[5] An estimate for the extent of processing of refined oil however shows a sharp decline in the same year 2007-08 because total oil production came down by a moderate 1 million tonnes due to the production shortfall.

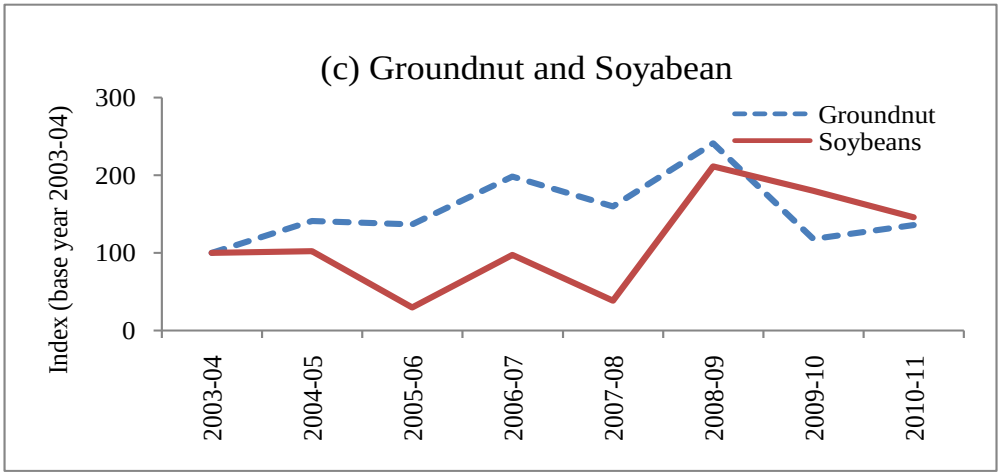
Table 5.1: Extent of processing in Organized sector of selected agro-products (%) over time in 2000s

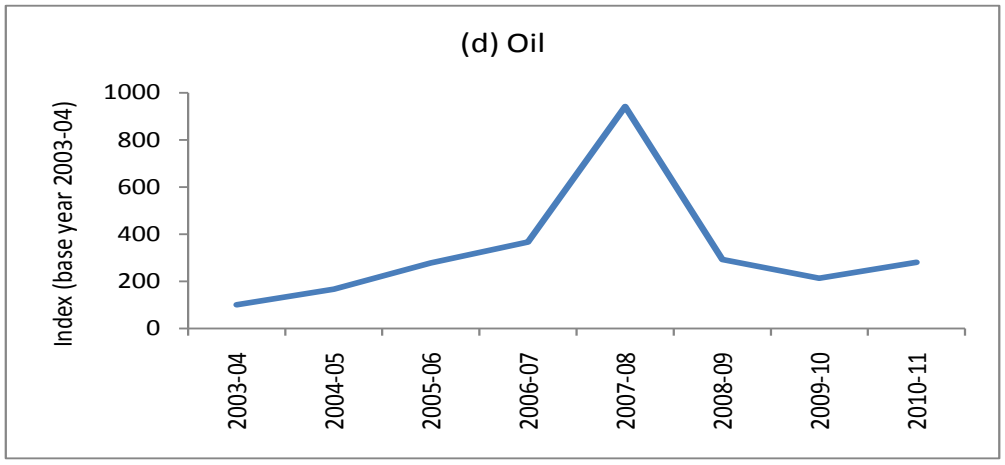
Crops	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Milled Rice	0.97	0.86	1.24	1.86	2.39	0.47	1.05	1.46
Milled Wheat	1.80	1.21	1.55	1.94	3.55	1.54	3.40	2.25
Milled Coarse Cereals	14.05	12.70	15.99	14.14	12.64	13.31	17.29	23.08
Milled Pulses	4.16	2.08	5.89	1.71	6.14	2.85	7.81	10.48
Groundnut	4.48	3.18	4.43	4.59	6.07	6.15	3.04	4.61
Soybean	51.28	31.02	11.63	29.05	10.70	47.49	44.78	34.88
Edible Oil	8.57	8.15	13.25	15.72	51.14	13.90	10.23	10.15
Fruits	0.77	1.10	1.73	1.32	1.81	3.06	2.12	2.40
Vegetables	2.91	2.52	3.66	2.13	2.25	1.88	2.54	2.25
Spices	8.55	6.93	5.23	12.66	10.14	9.02	9.29	10.27
Fish	11.00	9.25	13.54	11.19	11.64	9.92	12.79	7.24
Fresh Milk	9.96	9.45	10.93	13.58	13.21	11.89	12.48	5.29
Egg	1.83	1.97	1.68	3.72	1.34	1.88	1.95	2.82
Sugar	0.37	0.54	0.74	0.77	0.56	0.51	0.99	0.04
Meat	2.04	2.37	6.11	5.66	10.21	7.48	5.79	11.37

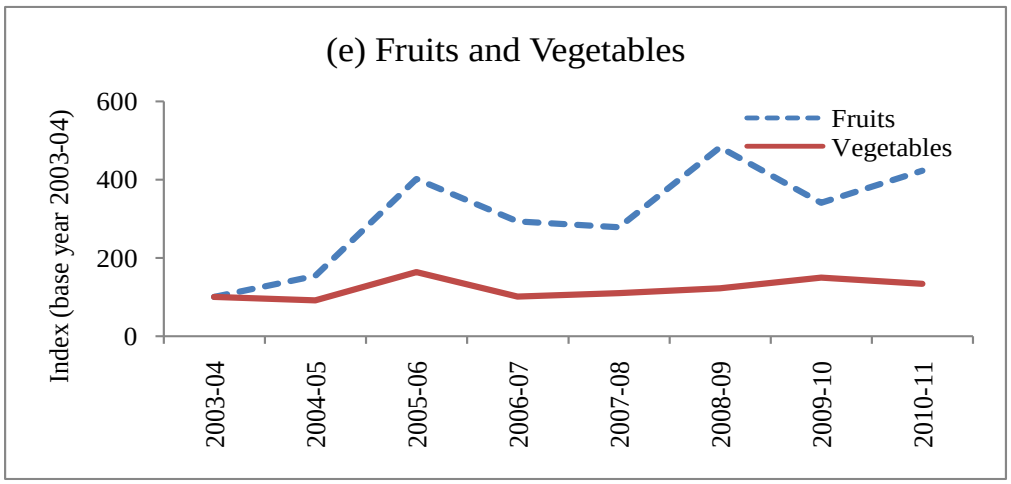
Note: All agro-processing considered. For selected items see Table 4.3. Source: Computed from ASI unit level data and MOA data.

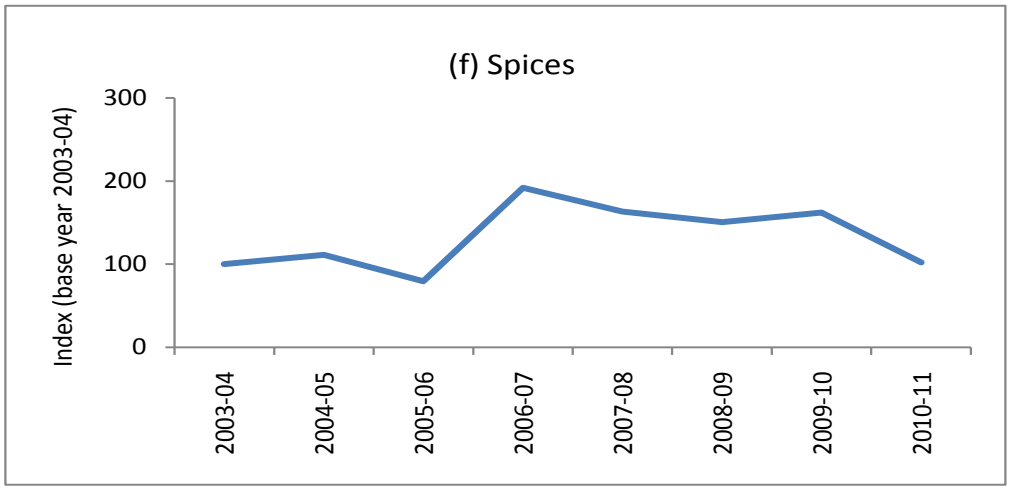

(a) Rice and Wheat
Index (base year 2003-04)
400
300
200
100
0
Rice
Wheat
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11

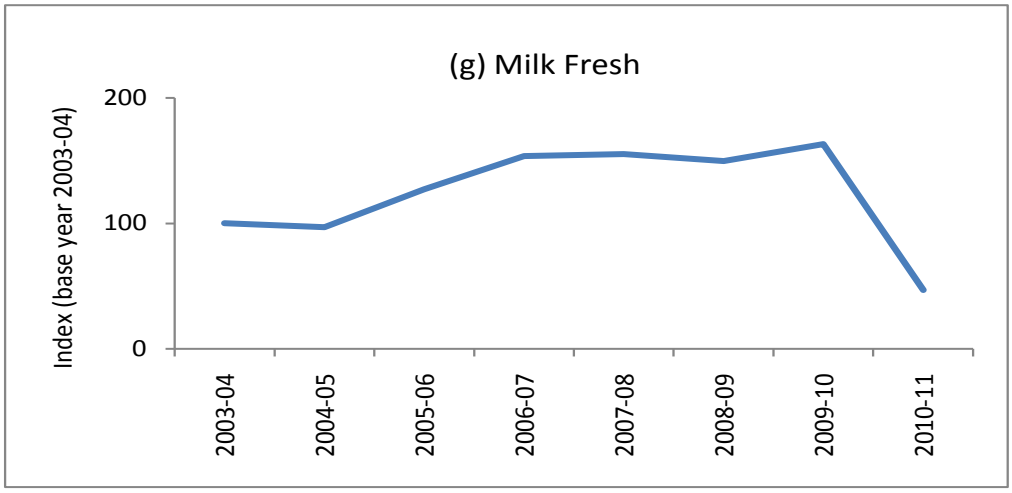

(b) Pulses and Coarse Cereals
Index (base year 2003-04)
400
300
200
100
0
Pulses
Coarse..
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11

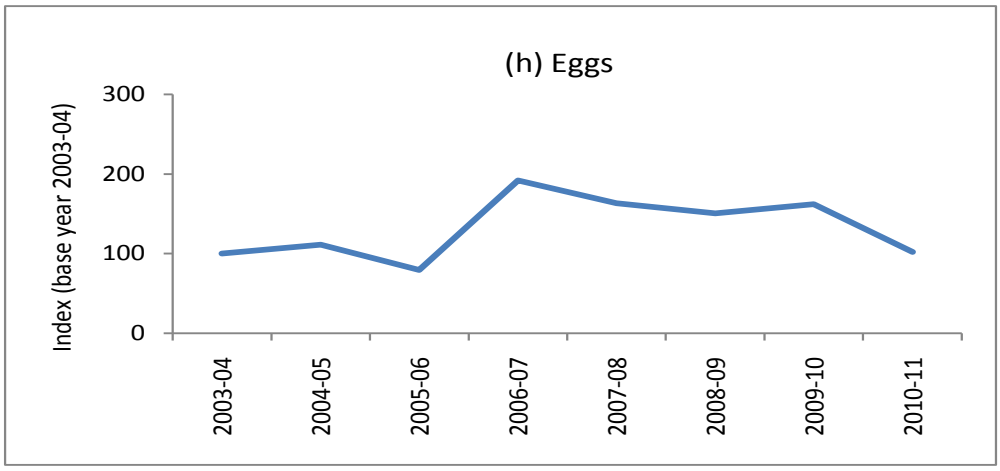

(c) Groundnut and Soyabean
Index (base year 2003-04)
300
200
100
0
Groundnut
Soybeans
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11

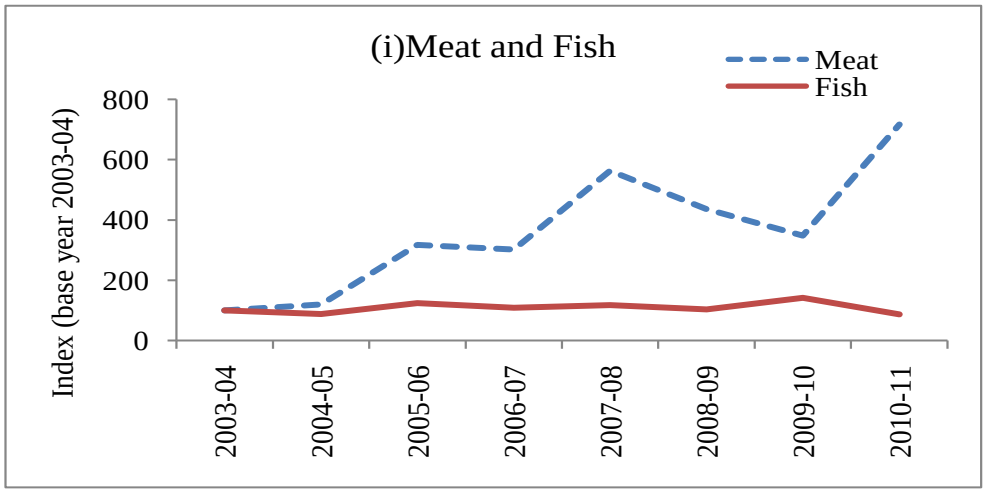

(d) Oil
Index (base year 2003-04)
1000
800
600
400
200
0
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11


(e) Fruits and Vegetables
Index (base year 2003-04)
600
400
200
0
Fruits
Vegetables
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11


(f) Spices
Index (base year 2003-04)
300
200
100
0
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11


(g) Milk Fresh
Index (base year 2003-04)
200
100
0
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11


(h) Eggs
Index (base year 2003-04)
300
200
100
0
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11


(i)Meat and Fish
Meat
Fish
Index (base year 2003-04)
800
600
400
200
0
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11

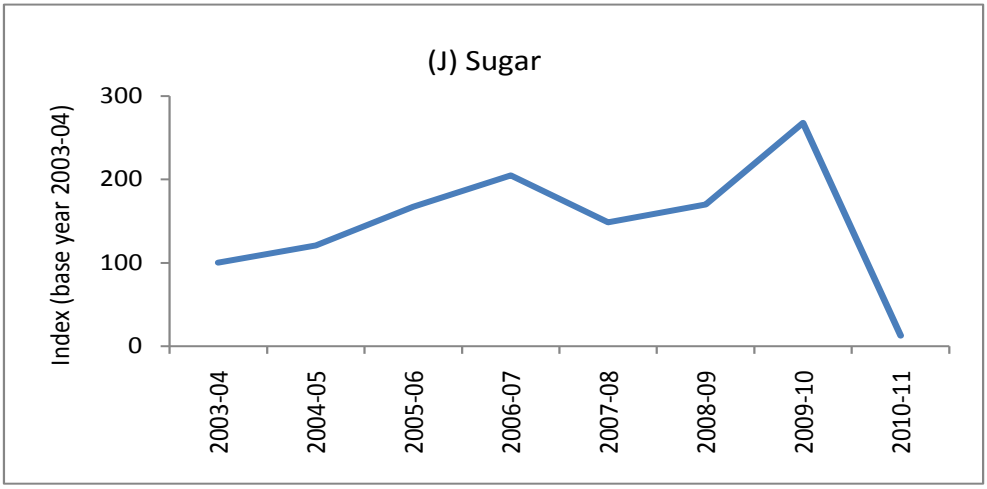


Figure 5.3 (a) to (j): Trends in physical quantities processed in sub-group aggregates of selected agro-products in the organised sector. Rice, Wheat, Coarse Cereals and Pulses are in Milled form. For selected items see Table 4.3. Source: Computed from ASI unit level data

5.5. The Unorganized and the Organized sectors in processing of Selected items

The availability of data from both ASI and NSSO for the year 2005-06 allows us to have a view of processing taking place in the unorganised sector too. Figure 5.4 however shows that in 2005-06 the unorganized enterprises had a much smaller role in food processing than the factories in the organized sector and the NSS data does not make a significant dent on the estimates based on ASI data only. In coarse cereals where processing level was small and mostly confined to maize the share of factory based processing was nearly cent percent and in milled rice too the share was nearly 90%. The unorganized enterprises however had a relatively larger role in milled wheat processing (bread, cakes etc.). It may be kept in view that processing of cereals is in any case at a low level.

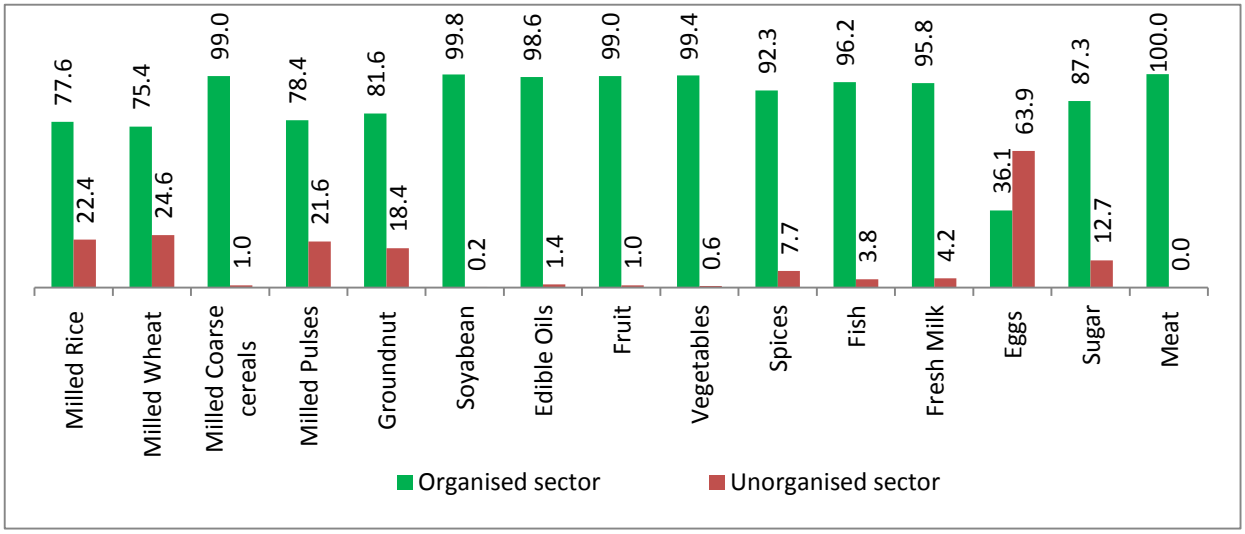


Figure 5.4: Percentage share of the Organised and Unorganised Sectors in Quantity processed in 2005-06. For selected items see Table 4.3.Source: Computed from ASI unit level data, NSS unit level data and MOA data.

The unorganized enterprises also had a moderately high share in respect of milled pulses, groundnut (excluding oil), raw sugar, fish and egg. Overall for 2005-06 taking both organized and unorganized sectors, 14% of fish and over 11% of milk and soyabean are processed and in all these cases the processing is largely confined to the organized sector (table 5.2).

Table 5.2: Estimated Extent of Processing of Agricultural products in subgroups of different selected items (All agro-processing) in 2005-06

	Share of produced quantity that is processed %			Mill. Tonnes
Crops	Organized Sector	Unorganized sector	Total economy	Total Quantity
Milled Rice	1.24	0.36	1.60	1.14
Milled Wheat	1.55	0.50	2.05	1.20
Milled Coarse cereals	15.99	0.15	16.14	4.10
Milled Pulses	5.89	1.62	7.51	0.48
Groundnut	4.43	1.00	5.43	0.32
Soyabean	11.63	0.03	11.66	0.73
Edible Oils	13.25	0.18	13.43	0.53
Fruit	1.73	0.02	1.75	0.45
Vegetables	3.66	0.02	3.68	1.71
Spices	5.24	0.44	5.68	0.17
Fish	13.54	0.54	14.08	0.84
Fresh Milk	10.93	0.48	11.41	10.48
Eggs	1.68	2.99	4.67	0.10
Sugar	0.74	0.11	0.85	1.84
Meat	6.11	0.00	6.11	0.27

Notes: Only for selected items. For coverage and Tables A4.2.1 and A4.2.2 for specifications of activities. For selected items see Table 4.3. Source: Computed from ASI unit level data, NSS unit level data and MOA data.

5.6 Results of Focussed analysis of 2005-06 data: Organized and unorganized sectors in processing Select items

Figure 5.5 illustrates the extent of all agro-processing activities for select agro-items under the sub-groups considering both organized and unorganized sectors. The extent of processing for cereals is high only in respect of coarse cereals because of the presence of maize (see also Appendix 5). Fish processing is substantial (14.1%) with the inclusion of marine products. Processing of meat is also nearly 6% with buffalo meat having a larger role than others. Estimates in respect of fruits and vegetables lie around 2-4%. Spices record a high 5.7% level of processing but grinding and packaging may account for a large part of this. The extent of

processing only of a more sophisticated nature specified as value-added elaborated separately in the appendix (Tables A5.4.1- A5.4.7).

Table A5.4 detailing the item-wise estimates of all agro-processing and value added processing indicates that value added processing is done only in a minor degree and exceptions are few. For fish 14.6% of the produce was processed in 2005-06 but value added processing (i.e., not simply sun-drying) accounted for nearly 13%. Though 4.5% of the milk produce is subjected to value addition, much of it is merely pasteurised (7%). Of the meat items, beef and buffalo meat are processed mostly for value addition. Live animals are necessarily primary processed but value addition is also observed in buffalo, sheep and chicken. The organized sector appears more active in processing all these items. Fruits and vegetables are processed also beyond primary level for value addition. Value addition is dominant for cashew nut kernel and shell and not in groundnut, soyabean and spices.

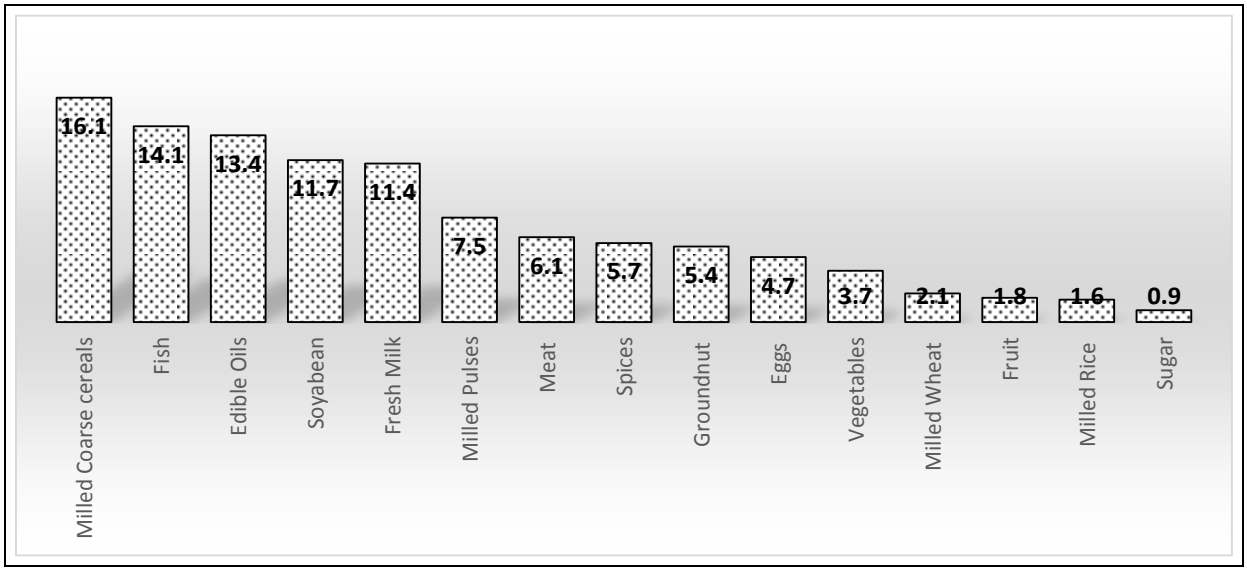


Figure 5.5: Extent of all Agro-processing (%) of various selected items in sub groups for 2005-06, organised and unorganised sector combined. For selected items see Table 4.3. Source: Computed from ASI and NSS unit level data and MOA data.

5.7. Extent of processing in exhaustive sub-groups

Aggregate estimates for the sub-groups taking also into account the non-selected items are presented in Table 5.3. Also, besides the selected subgroups, a few more subgroups are also dealt with, some of them being the semi-processed or unprocessed versions of the same items. In the case of unmilled raw products where primary processing may be deemed basic in character, the extent of value added processing is only reported treating milling to be essential.

The differences between the exhaustive sub-groups in Table 5.3 and the selected items as given in Table 5.1 for the same subgroups are noteworthy. The extent of processing (EPA) actually exceeds that approximated by selected items in the subgroups of milled coarse cereals and spices indicating that there are items outside the selected list that stands out in terms of their potentials in processing although some degree of presumption is associated with this finding (see Chapter 4). The estimates of the additional individual items in the exhaustive sub-groups could not be worked out for want of price and production data.

Value added processing of cereals (Unmilled Paddy, Wheat, Bajra) as also pulses is fairly small. Processing of Unmilled Pulses which includes milling is however high at over 30% (see Table A5.4.4). Processing of oil which is itself primary processed is considerable and is not stable in extent as noted earlier also. The estimate is enhanced by including the non-selected oils but as with the selected aggregate, there is a sudden peak in 2007-08. A decomposition of our data shows that although groundnut oil, soyabean oil and other oils (n.e.c) are important constituents of the processed basket, processing of mustard oil and other oils is remarkably higher in that year. Substitution among the different oils associated with the scarcity caused by the low production in base year 2006-07 may also have been a factor behind the behaviour. Mustard oil production was found satisfactory in 2006-07. Processing of fruits and vegetables as an exhaustive category is even lower than that consisting of only the selected items because the selected items were relatively more intensely processed as shown in section 5.3.2.

Table 5.3: Estimated Extent of processing of all Agro-products under the sub-groups in the Organized sector (%)**

Crops	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Coarse Cereals milled	14.74	14.96	17.41	15.70	13.55	15.65	19.65	26.17
Paddy*	0.66	0.07	0.60	0.33	0.29	0.32	0.93	0.50
Wheat, Raw*	4.98	0.44	0.19	0.00	1.06	0.00	1.27	1.25
Bajra Unmilled*	0.47	0.24	0.61	0.93	0.08	0.48	0.45	0.14
Unmilled Pulses*	2.77	0.24	0.32	1.60	1.22	1.23	1.62	0.96
Milled Cereals	3.52	3.69	4.31	4.37	4.71	3.75	5.33	6.05
Milled Pulses	4.04	2.34	4.17	2.10	6.02	2.98	7.13	8.42
Oil	22.85	13.89	17.29	17.39	39.41	21.78	15.45	29.14
Fruits	0.39	0.50	1.03	0.75	0.03	0.02	1.47	1.43
Vegetables	1.80	1.49	1.16	1.58	0.77	1.38	2.22	2.03
Spices	4.24	4.37	7.86	7.52	9.03	9.83	16.44	24.84
Animal live*	11.23	67.69	3.13	6.36	17.15	60.60	16.79	12.59
Meat	1.86	3.39	8.30	4.47	9.13	9.19	8.45	9.53

Note: * Estimates for value-added processing only. **The coverage extends to items not among selected items. See tables A4.2.1, A4.2.2 for specification of activities. Source: Computed from ASI unit level data and MOA data.

5.8. Projected Estimates for 2010-11 including Basic Processing

Owing to the severe limitations inherent in the data (see section 4.8) received from NSSO on the unorganized sector, estimates for 2010-11 are made using four alternative plausible assumptions about growth rates of the quantity of material consumed in the sector. Although theory supplies little guidance for placing special confidence on any of these assumptions, two of the assumptions are relatively strong, implicating possible overestimation. We opted to place greater reliance on the assumption of no growth in quantity ($g=g_2$) which essentially constricts the quantity of material inputs in 2010-11 to its 2005-06 level. In Table 5.4 the expected level EPA is made with this assumption but is supplemented by the maximum and minimum estimates defining the range under the four alternative assumptions. In the same way, the total estimate for the economy is arrived at using the ASI based estimate added to the respective projected estimates obtained from the NSSO data. The estimates under all four assumptions are given in tables A5.5 and A 5.6.

Table 5.4: Extent of quantity processed (%) in total economy for all activities of select agro-products in 2005-06 and 2010-11 (projected).

	2005-06	2010-11 (projected)		
Items/ crops		Baseline	Minimum	Maximum
Milled Rice	1.59	1.80	1.75	1.89
Milled Wheat	2.05	3.08	3.02	3.52
Milled Coarse Cereals	16.15	23.23	23.21	23.30
Milled Pulses	7.51	11.37	11.25	13.37
Groundnut	5.43	5.82	5.65	5.77
Soybean	11.65	34.89	34.89	34.96
Edible Oil	13.43	10.29	10.27	10.29
Fruits	1.75	2.42	2.42	2.42
Vegetables	3.69	2.27	2.26	2.27
Spices	5.67	10.67	10.62	11.12
Fish	14.08	7.66	7.53	7.64
Fresh Milk	11.41	5.72	5.52	5.70
Egg	4.67	5.17	4.84	7.82
Sugar	0.85	0.13	0.05	0.13
Meat	6.12	11.37	11.37	11.37

Source: Computed from ASI and NSS unit level data, MOA data.

The results for 2010-11 can be summarised as follows. The extent of processing (EPA) is only in the range 3.02 to 3.52% for wheat while the level is even lower for rice ranging between 1.75 to 1.89% with an expected value of 1.80%. The same estimate is remarkably higher for coarse cereals at over 23% even at the minimum. Two explanations can be given to justify the disparity between the estimates for coarse cereals and the two main cereals. The large amount of procurement of these two grains by public agencies that canalize the grains away from the food processing route is one possible factor while the multifarious use of maize for food and non-food purposes is another that makes coarse cereals more potent as industrial inputs. Between 11.25% and 13.37% of the milled pulses are processed. Soyabean, oils and meat are also substantially processed within narrow bands set by the assumptions of the unorganized units. The processing of fresh milk is low in 2010-11 relative to the other years. The milk economy has been facing increasing pressure from the middle of 2000s decade.

Compared with the figures obtained for the year 2005-06, the extent of processing is indicated to have increased only modestly in respect of the milled cereals rice and wheat, milled pulses,

groundnut, fruits, and egg, while the increase is more substantial in respect of milled coarse cereals, soyabean, spices and meat. Decline is observed in respect of edible oil, vegetable, fish, fresh milk and sugar. Several factors may be responsible for the variations, such as price rise, trade policy, investment confidence, technological changes and government's procurement policy. The choice of the two years is decided purely on the basis of the availability of data, reflective of short term causalities and not any definitive tendency.

5.8.2. Basic Processing

Although, at first glance the estimates of basic processing seem to embody a trivial connotation to the extent that these processes are essential for edibility, these results are also worth consideration. They help in validating the whole method and also in conveying a broader picture of product disposition and the implication of the public policy because milling is also a service. Above all, the participation of the organized sector in primary processes such as milling activities is also a milestone in food processing signifying technological modernization and a shift in consumer preference. We therefore also estimate the extent of basic processing of select items separately.

Basic processing by our definition excludes milling as a service where the purchase of raw grains do not appear as cost. In the case of rice and wheat the public procurement operations are highly active in India. Generally these operations are directed towards the benefit of consumers especially the poor and the targeted ones. When the agencies buy from the farmer raw grains and distribute them, usually from Public Distribution System (PDS) outlets, as milled grains, only milling services are availed by the public agencies without involving any commercial processor. In the case of wheat, distribution is done mostly or wholly in unmilled form giving consumers the prerogative to buy services from millers while on the contrary, paddy procured from farmers is milled before it is distributed as rice. However only part of the rice is procured from farmers and is distributed as custom-milled rice (CMR)[6]. There is also a component of levy rice[7]

[6] Custom-milled rice is purchased as paddy by public agencies in regulated wholesale market at minimum support price (MSP) announced in advance. The paddy is then milled at government cost.

purchased from millers in which case the paddy is a purchased input of the miller who however is obliged to sell part of the milled rice to the procurement agency. Over time, the government increasingly procures directly from farmers and the proportion of levy has declined (Gupta, 2013) to about 30%. Because rice procured through the levy channel enters in our estimate of EPA, the evident public shift towards CMR is likely to push the estimate down.

Thus it is not surprising that we find in Table 5.5 estimates of basic processing to be far less than 100% except for sugarcane for which over 90% is milled, that too mostly in the organized sector. Sugar cane has a long and varying growing season in India with spatial differences. The milled output sugar, mollasses and khandsari are often co-produced and not necessarily mutually exclusive creating complexity of measurement. By our specification, 24% of paddy and 17% of raw wheat undergo basic processing. The extent of basic processing has declined for both wheat and paddy as anticipated but increased for oilseeds. Most of the basic processing occurs in the organized sector which is also responsible for the decline. Of the oilseeds the estimate is high at 28% which increased from 15% in 2005-06 mostly in the organized sector. Rapeseed mustard does not figure in basic processing in unorganized sector. In addition to basic processing a small proportion (less than 1% in all the cases in 2005-06) of the net raw produce is also consumed in value added producing.

The data on procurement are available in official sources (MOA_a, various) but an estimated 43% of paddy possibly undergoes basic processing[8] by going through the levy channel before procurement. Besides this the grains are also distributed through welfare schemes, exported via state agencies by inviting bids and disposed by open market sale in different forms while private traders also resort to stocking and exporting in different forms subject to strictures laid down by the government from time to time. All this creates information gaps in assessing the part of the rice grain passing on via processors but the path can be explored to assess our estimates.

[7] In the levy channel, millers have to sell a fixed proportion of their rice output at as levy at price pre-determined by the government based on estimated milling costs, MSP and mark-ups.

[8] Based on Gupta, 2013 figures for 2000-01 and 2010-11, levy was 54% and 32% respectively of total paddy procurement.

Table 5.5 : Extent and nature of processing (%) of unmilled cereals Paddy and Wheat 2005-06 and 2010-11 (Projected)

Nature of processing	Activity sector	Nature of Organization	Raw Wheat 2005-06	Paddy 2005-06	Raw Wheat 2010-11	Paddy 2010-11
Basic processing	Manufacturing sector	Organized	15.54	21.08	7.37	20.63
		Unorganized	1.31	3.38	1.02	3.28
		Combined	16.85	24.45	8.39	23.92
Value added Processing	Manufacturing sector	Organized	0.19	0.60	1.25	0.40
		Unorganized	0.08	0.16	0.05	0.15
		Combined	0.27	0.76	1.30	0.56
Other Primary processing	Manufacturing sector	Combined	0.47	0.78	0.46	5.73
Milling (Residual)	Service sector	Combined	82.41	74.01	89.85	69.79
	Total		100	100	100	100

Note: Estimate for 2010-11 in unorganized sector constituted of unregistered processors and combined sectors making up the total economy are baseline estimates assuming g1 to hold true (see Chapter 4 Section 4.3.1) The residual of production over seed feed wastage and over all processing done as manufacturing activity reported by data sources are assumed to be milling as a service activity. Source: Computed from ASI, NSS unit level data, MOA data.

The low figures for rice and wheat are validated by working out estimates of surplus in Table A5.8 using alternative sources for specification of grain disposition. In estimate 1 we use estimates of farmer's disposal of raw grains as provided by DMI (2005). Such disposals include direct sales and sales to cooperatives as also the use of grains for household consumption and payment in kind. However these figures may be outdated, the survey having been conducted during 1996 to 1999. Also, the use of DMI's estimates in conjunction with the application of the estimate of levy on MOA's published procurement figure is questionable. The surplus which may be indicative of farmers' commercial sale of raw grains is higher than our estimate of processing of raw grains considering only basic and value added processing in the case of rice. For Wheat, it is low and the surplus is found negative in 2010-11.

An alternative approach used may be more reasonable but involves the assumption that all consumption of grain in rural households from sources other than public distribution outlets constitutes purchase or other receipts of raw grain and therefore acquisition of milling services by the rural consumers. The consumption data is supplied by NSS and reported in Agricultural Statistics at a Glance (2013). The surpluses calculated as estimate 2 are lower than both the

estimate 1 and our own estimates of basic (and value added) processing for paddy and higher in case of raw wheat. In either case the difference is not more than 10 kg and is fairly close if the more credible estimate 2 is considered.

In 2010-11 basic processing of wheat and rice declined to 8.4% and 23.9% respectively, that of oilseeds increased to 27.8% while the level remain almost same for sugarcane. The reduction noted in the case of wheat and paddy may be explained by the expansion of public operations, more remarkable in wheat whose procurement went up from 25% to 34% of the production, and the growing role of the CMR route of procurement of paddy. In all cases the extent of value added processing of the raw products is very small but some visible increase is observed with respect to oilseeds and also wheat.

5.9. User industries identified and use of co-products

Even in the entire domain of productive activities identified by all NIC codes, only a few industries are observed to be using agricultural products as inputs (ASICC Code up to 16000). Food processing including basic processing, agriculture, tobacco and pharmaceuticals are dominant and not surprisingly, food processing as a composite group dominates as a user, covered in rows 2 to 13 in Table 5.6. Its share is more than 66% in both the organised and the unorganised sectors and the sub-sectors delineated by 5digit NIC codes include the following activities: processing and preservation, dairy, grain milling, bakery and sugar all of which may be processing some amount of agricultural products. The total share is even higher if beverages often made from grains as also fruits, are considered as food processing but the share of this activity is only 2.8% in the organized sector compared to 0.4% in the other sector.

Of all the activities, grain milling is the largest user of agro-products accounting for nearly 43.8% of the value of procurement in the unorganized sector and 22% in the factories. Sugar has a relatively large share of 16% in the organised sector. Food products like Macaroni and Noodles have over 4% share in unorganised sector. Besides agriculture, tobacco and pharmaceuticals are also found to be users but use by tobacco industry is insignificant which is found to use only

sugar as input[9]. It may be noted that though agriculture according to NIC relates mostly to production of crops and animal products, agriculture is also found to be a user of its own products[10] but its share is only 0.6% in the organised sector. Pharmaceuticals and chemicals together have share of 1.6% in the value of agricultural inputs in the organised sector, while their share in the unorganised sector is further less. Bio-gas energy is identified as another user of agro-inputs but the use is small and confined to factory based production.

Several other activities not included in rows 1 to 18 in Table 5.1 account for over 30% of the procurement by the unorganised units. Their contribution is less in the factories. These activities, as seen by tracking their NIC codes, are undertaken in chemicals, electricity generation industries and in making furniture, brooms and crafts. It may be noted that components and by-products of cereals such as bran, husk, gluten find use in several activities (see Table A5.4.5). For example gluten is found as an input in manufacture of non-defatted flour or meals of oilseeds, biscuits, cakes and pastries and beverages. Bran of rice and wheat appear as inputs for manufacture of chemicals (including paints, ink), basic chemicals, bricks, structural clay and generation of electricity (NIC-2004, 3 digit-code142). Husk is used in food processing, pharmaceutical and botanical products, chemicals, agricultural tools, electricity generation and making of items like brooms and brushes. Bagasse is used in food processing, creating coke oven products, paper products, wood cork, straw products and bricks besides generation of electricity.

Table 5.6: User industries of inputs from Agriculture

[9] Note that tobacco is not among the agricultural products considered for this study. (see Table 4.3)
[10] NIC code (1998) - 014 (Agriculture and animal husbandry service activities, except veterinary activities)

Group based on activities (NIC Code 2004)	Shares of major sub-sectors of processing* in the total Value of Inputs sourced from agriculture (%)	
	Unorganised Sector	Organised Sector
1: Agriculture, Hunting and Related Service Activities (011-015)	0.03	0.58
2: Production, processing and preservation of meat. (1511)	2.96	1.24
3: Processing and preserving of fish and fish products (1512)	0.10	3.54
4: Processing and preserving of fruit and vegetables (1513)	0.39	0.74
5: Manufacture of vegetable and animal oils and fats (1514)	1.23	17.30
6: Manufacture of dairy product (152)	3.64	12.98
7: Manufacture of grain mill products (1531)	43.85	21.79
8: Manufacture of starches and starch products (1532)	0.27	0.92
9: Manufacture of prepared animal feeds (1533)	0.32	3.34
10: Manufacture of bakery products (1541)	3.44	1.90
11: Manufacture of sugar (1542)	2.42	16.22
12: Manufacture of cocoa, chocolate and sugar confectionery (1543)	2.89	0.50
13: Manufacture of macaroni, noodles, conscious and similar farinaceous products and manufacture of other food products n.e.c. (1544)	4.09	6.83
14: Manufacture of tobacco products (1600)	0.58	2.83
15: Manufacture of other chemical product (gelatins etc.) (2429)	0.01	0.97
16: Manufacture of beverages (155)	0.37	2.82
17: Manufacture of pharmaceuticals, medicinal chemicals and botanical products (2423)	0.12	0.64
18: Generation and distribution of bio-gas energy and generation of electricity from other non-conventional sources (40107-40108)	0.00	0.03
19. Others	33.29	4.82

Note: Based on ASI and NSS 2005-06 unit level data only. The 'Other' user category includes a range of activities such as chemicals, paints, varnishes, inks, bricks, porcelains, electricity generation, tools, manufacture of items like furniture brooms, brushes and craft etc. * Processing includes basic processing and covers all milled and unmilled agro-products.

6. Concluding remarks

While food shortage is one of the biggest problems a society can face, it is also observed that when enough food is supplied, people become concerned with considerations of safety, security, nutrition and convenience. The problem of food insecurity then continues in a metamorphosed state. As an economy grows, food security begins to encompass a comprehensive connotation that now includes along with sufficiency, the quality, content, presentation and packaging protocols embodied in the food. Food processing is a growing science. The technology developed imparts qualitative changes on the items produced in agriculture and also in the way and form it reaches the consumer.

6.2. Food processing and the implications of developing the Sector

Food processing is defined as a 'synergic application of different physical processes to transform raw animal or plant materials into consumer-ready products'. While in a trivial sense, food processing is nearly as old as human civilization and the discovery of fire and the preparation of food from natural products was a continually evolving process in the domestic and at best in the informal domains of various societies, modern food processing that draws from scientific methods and endures and address onslaughts of critics from various disciplines is of relatively recent origin. Developed more for military needs in the US than to meet consumer demand at the outset, the key technologies possibly date back only to the middle of the 20th century. Over the years, processed food products however also gained commercial acceptance and reached the shelves of the food stores in an expanding orbit. Practices developed in different countries began to fuse in widening the range of food products to suit and activate exchanges among cultures. It is not surprising that the food industry aspires to reach out to different markets including those of developed, developing and emerging countries as globalization progresses.

It is expected that the food industry will help to prevent and reduce the negative changes in food quality, to generate an ever widening variety of food rich in colour, texture and flavour to please

consumers and to adapt and develop new processes to satisfactorily meet the requirements of wide demographic variety within different cultures. In the process, growing regulatory procedures impose obligations for compliance. It is also meant to deliver convenience and comfort to household members engaged in making food palatable. It becomes a strong support for the empowerment of women who not only obtain relief from domestic constraints but also find economic opportunity in the expanding sector. Strong scientific foundation is replacing empiricism in food processing so that the health conscious consumers are provided with choices along with information on the content of food. Above all, processing of perishable products can play an important role in reducing wastage of food, which in turn translates to saving of valuable water and soil resources and to reducing carbon emissions.

6.3. Food Processing as a promising sector in Indian Industry

India has a large agriculture base and her food production has grown manifold in the post-independence years. The wide range of topography, soil quality and climatic conditions that describes India makes her agriculture advantageous for producing a large number of crop and non-crop products. Agriculture also remains the key source of livelihood in India but the people engaged in farming are known to be relatively poor due to the low income generating capacity of the occupation. Structural transformations within agriculture, development of new marketing channels and changes in dietary habits owing to globalization, urbanization and the dynamics in social codes however create new opportunities for agriculture to emerge as a leading economic sector. Many of the farm products especially animal based products, horticultural products and also some of the traditional crop products are amenable for processing into food products or other end uses.

What makes food processing as a sector within industry stand out is its tacit integration with agriculture in the economy and its strategic location in the supply chain of agro-products. Strong links between agriculture and industry can be a key to take agriculture forward because they make the relation among farmers, processors, consumers and other agents in the supply chain synergic such that returns from investments are diffused across the entire chain through

feed back and spill over effects. Investment in industry is likely to be reflected in higher returns to farming. Farming in India is characterized by low returns which diminish its appeal as an occupation among the youth in contemporary India. Investment on agriculture also enjoys little incentive. Exit from agriculture is becoming the popular option for the rural youth leading to migration and pressure on urban areas. In this situation food processing industries by virtue of their linkage with agriculture can play a promising role.

The growth of a food processing sector in India can thus help in improving the productivity in agriculture, returns on farming and employment in both agriculture and industry by creating an additional and organized market for agro-products. Moreover, promotional policies can provide choices, information and healthy food to consumers while subjecting the sector to regulatory compliance and public exposure. The higher productivity induced in agriculture and the technology of nutrient preservation can go a long way to conserve land, water and other resources as well as waste management. The Government of India promotes the food processing sector through a separate Ministry of Food Processing Industries (MOFPI) which oversees different schemes and programmes relevant for the purpose. In order to effectively monitor the impact of existing schemes and to formulate appropriate policies, it is vital to maintain reliable data relating to production and other aspects of the sector and to assess the performance and usefulness of the sector. The measurement of the linkage between the food processing and the agricultural sector will be part of the monitoring process. Rising level of agro-processing will be indicative of greater agro-industry linkage.

Estimates of the extent of food processing would essentially measure the strength and character of the linkage between agriculture and industry. Unfortunately no systematic and scientific data pertaining to food processing activities and their demand for agricultural products based on 'harmonised concepts, definitions and classifications' is apparently available. This report attempted to compute these estimates for India using systematic specifications and a methodology that is well deliberated, transparent and amenable to further improvements. Suggestions and comments received on a draft report submitted earlier are taken into consideration (Appendix A 6.1, A6.2)

6.4. Measuring the extent of processing: Review of Literature

Estimated measures of the level of processing world over can serve as benchmarks to show competitive performances, indicate regional specializations and provide signals on demand and supply in the international markets. The strength and weaknesses of the methodologies followed can set the tone for measurement protocols in the world at large to generate estimates that are more reliable and comparable across countries. The key to this endeavor would be to develop a uniform, transparent and scientifically sound methodology that may be accepted for use by different states and countries to report their own estimates that are mutually compatible and comparable.

Agro-processing in some form has traditionally been an economic practice in most countries. In most developing countries these activities have been carried out in small and medium units that use traditional technology, family labour and operate informally. In centralized economies like Russia, the notion of food processing was implicit in the policy of vertical integration that would combine production in collective farms and downstream processes under the same umbrella. In recent times as trade is being liberalized that food processing, as a most important sector, is deserving of technological and managerial advancements is increasingly being recognized. The sector has begun to receive attention as an industry group with considerable emerging potential in the literature at the academic level and in reports of international development agencies.

While the level and potential of food processing has been discussed widely in literature, in reality credible attempts to work out estimates of the level of processing are visibly few. Certain estimates have found peripheral and casual mention and citation as a backdrop to other contexts (Box 6.1) but the precise specification of food processing, the coverage of items, the methodology and the source of data that was used hardly find any space for elaboration. For instance both in reference to Russia and China, it is suggested that one-third of agro-products have been processed and relative to the Asian and the African countries, the level of processing in the western countries like the US and the EU is indicated to be very high, 80% and 70% in US

and France respectively, but certainly, more rigorous assessments are needed to establish these facts. Websites like those of the USDA and OECD do not officially post any data on the extent of processing till date.

Box 6.1 Estimates at the international level of the extent of Food Processing

Liu et al. 2007 - In China 30% of food is processed compared to 60-80% in Western countries. The method or source is not mentioned.
D'Essence Consulting , (2009): US 80%, France 70%, Thailand 30%, Malaysia 80%, Australia 25%, Netherlands 12%, India 1.3%. The source is stated to be Rabo bank.
Ioffe and Nefedova, (2001) - Processing level in Russia is stated to be one third
KPMG-MOFPI-FICCI (2007)*- For fruits and vegetables the figures given are 65% for USA, 78% for Philippines and 23% for China. The study also reports 60-70% processing of poultry and 60-75% processing of milk in developed countries. Besides at the overall level, the report states that processing of agricultural produce is around 40% in China, 30% in Thailand, 70% in Brazil, 78%in Philippines and 80% in, Malaysia. These figures are widely quoted in literature.
NSDC (2010): Level of processing quoted as: 40% in China, 30% in Thailand, 70% in Brazil, 78% in Philippines and 80% in Malaysia. The source is given as MOFPI and IMaCS analysis

* Ministry of Food processing Industries (MOFPI) Government of India however clarifies that it has never conducted such type of study in the past.

6.5. Food Processing in India: Analysis of secondary data and information

Official data and literature on Indian food processing suggest that the major growth segments are identified to be fruits and vegetables (pulps, juices, ready to serve beverages, jams, squashes, pickles), dairy (packed milk, ethnic sweets, curd products, ghee and milk powder), meat and poultry (buffalo meat, mutton, lamb, poultry), marine products (fresh fish, frozen shrimps, fins, cattle fish and squid) and beverages alcoholic (beer, wine Indian made foreign liquors) and malted.

Interestingly, an analysis of secondary published data suggests that although a very large number of unregistered units of fairly small sizes engage in processing food, they account for a mere quarter of the value generated. Nearly 80% of the employment in food processing however is confined to this unregistered sector. The unorganized enterprises also have a spatial diffusion more scattered than the organized sector in which four states Andhra Pradesh, Tamilnadu, Punjab and Maharashtra account for over half the total number of enterprises. The largest numbers of unregistered units are in Uttar Pradesh, West Bengal and Odisha. Intriguingly, over time after liberalization, the factories are found to be showing stronger performance but the value of production grew much faster than employment and the number of units while in the unorganized sector both the number of units and the employment of workers declined. More number of unregistered units are located in the rural areas but a shift towards urban areas is visible.

As already noted, some estimates of the extent of processing of agro-products signifying an aspect of the linkage between industry and agriculture are available in literature but with little elaboration on the methodology accompanying them, the credibility of the estimates is shrouded and they can only serve as indicative of the status.

6.4. Discussions: Estimation of Extent of Food processing in India

Though reliable sources and due caution underlie the exercise the results are unquestionably sensitive to the assumptions and specification made. Food processing in our method embraces all possible outputs regardless of their use and specific inputs that are edible in nature and are derived from agriculture are considered. The estimates of the extent of food processing also exclude basic level processing such as milling and crushing that is essential for making raw products edible but the extent of basic processing is also assessed separately..

The results suggest that cereals, apart from maize, are processed only to a small extent. Possibly, this reflects at least partly the government's procurement policy that largely bars the grains from reaching commercial processor even at the basic level[1]. Retention for subsistence use of grain by farmers for their own food security also restricts products from reaching processors. Unmilled and milled grains do also find use in value added activities but to a small extent only. Even milling remains to be dominantly a service to the consumer in India.

Commercial processing of milled grains as a manufacturing activity is relatively low and is only 1.8% of rice and 3.1% of wheat in 2010-11 (Table 5.4) and the incidence of relatively sophisticated value added processing is even less. Even basic processing (milling of grain as a manufacturing process) is far less than 100% indicating that a considerable amount is custom-milled by the owner who may be farmer, consumer or the government. For paddy, raw wheat and oilseeds 24%, 17% and 15% are milled as manufacturing activities in 2005-06. The organized sector is dominant in these milling activities and less than 4% and 2% of paddy and wheat are milled in the unorganized sector. The reduction of basic processing noted in latest decade in the case of wheat and paddy can be explained by the expansion of public operations over the years which was more remarkable for wheat whose procurement went up from 25% to 34% of the production. The growing role of the CMR route (direct purchase of paddy from farmers by government agencies) of procurement of paddy expands the scope of rice milling as a service and not as manufacturing[2]. Basic processing at the commercial level, given the performance of their production, however increased for oilseeds.

[1] Purchases from public open market sales operations may also find their way to processors.

[2] The changing pattern of rice procurement is strongly resisted by the miller's lobby and the state governments. It is reported that Union Food Ministry's proposal to cut down procurement of levy rice from 75% to 25% (Business Line October 20, 2014) is raising fears of possible cartelization among millers who will gain greater market exposure and power. The Food Corporation of India and the State Government Agencies first procure paddy from farmers and get it custom milled from millers at fixed tolling charges. FCI makes payment at minimum support prices and store the stocks with rice millers under the CMR agreement. The argument against the direct protection given to farmers is grounded in the fact that even under current dispensations, the farmers already have wide market exposure and the move towards greater emphasis on the CMR route will only help to create large stocks to which millers will have possession and not ownership (Business Line, June 5, 2014).

Maize is seen to be the most outstanding of the cereal products that is processed commercially which makes the extent of processing of coarse cereals 16% in 2005-06 and 23% in 2010-11. This is because government's operation in maize is minimal and maize is finding increasing number of uses as food products, feed, fuel and industrial inputs. The extent of processing is low for a number of other products but pulses, soyabean, edible oil, fish, milk, meat and spices are processed to a appreciable extent. Between 2005-06 and 2010-11 the extent of processing increased only for a few products, coarse cereals being the outstanding example. Processing of soyabean and edible oil is found to be unstable over time possibly responding to vacillating trade policies, substitution possibilities among the different oils and the unstable production performance of oilseeds such as groundnut. The organised sector is the dominant processor despite the large number of small unit undertaking similar work. The presence of the unorganised sector in processing is felt more perceptible in the case of milled pulses and groundnut but in all cases the share of the sector falls far short of the organized sector.

6.5. Comparisons

As already mentioned a number of assumptions and corrections deemed to be reasonable and necessary constitute the methodology behind the estimation. The robustness of the estimates is reflected only by their consistency over time. There is hardly any alternative measure available in the literature with which to compare and validate these estimates. Also our estimates are with respect to net production of the previous year visualized as the corresponding agricultural year as the base. In reality, items drawn from carried over stock can appear as inputs in processing. Given the complex nature of agriculture it is not simple to determine the period, current or past, as actually constituting the base line source of material. This determination is even more difficult in the cases of pernennial and sugarcane which has a very long and diverse growing season. The allowances for seed, feed and wastage are also estimates and the validity of our estimates is influenced by the accuracy of these estimates that determine the net production base for processing. With the quantity data or their units of measurement being questionable for both official data sources greater confidence has been placed on estimates of values and the quantities

processed are derived using assumptions and relying on the data on prices. The exercise is conducted under many limitations.

The Food Balance Sheet (FBS) published in the open domain by the FAO in FAOSTAT is a potent source of data presented in a comprehensive manner although basically it offers a way to assess nutritional adequacy of different countries. In most countries exposed to global market considerable imports are made and imported products domestically processed are included in the FAO data. Correcting for net imports and net stock depletion we found that levels of processing are low in respect of cereals (0.26%) and fruits (0.46%) in 2009-10 and high for oil crops (76.3%) and sugarcanes (95.86%) in India. India's rank is relatively low among the countries Brazil, Malaysia, China, Philippines and Thailand. The extent of processing based on FAO data are 8.5% in Brazil and 5.7% in Thailand for cereals, 6.2% in China for fruits, 96% and 90% for oil crops in Malaysia and Brazil and over 99% for sugar crops in China, Brazil, Philippines and Thailand. Similar estimates work out to reasonably high values in Western countries. For example, the extent by FAO data is found to be as follows-
Fruits: 50% in France, 13% in Russia and 9% in USA
Cereals: 33% France, 25% in Netherlands, 16% in Russia and 78% in USA.

It is apparently also common to work out crude estimates founded purely on insights and insider information from processing industries. While estimates of these natures have only served for policy making, given the lack of clear specification, underlying methodological rigour and of uniformity across countries, as food processing emerges as an important driver of growth, employment and trade, the need for more objective information that is presentable for public scrutiny can no longer be procrastinated.

Compared to available citation of estimates of food processing, our estimate is small at 1.1% for fruits and vegetable considered as an exhaustive macro-group compared to the widely quoted estimates of 2%. 2.1% and 2.2% (NSDC, 2010, D'Essence Consulting 2009, KPMG-MoFPI-FICCI, 2007). Analogous estimates worked out using the Food Balance Sheet of FAOSTAT also exceed our estimates though by a smaller margin (Table 6.1). Similarly our estimates stand lower

than the alternative estimates from KPMG-MoFPI-FICCI report or those from FAOSTAT data except for milled cereals in which case maize makes a difference. The difference is most striking for milk where our estimate is 11% while other estimates surpass 30% but the methodology may be different. The specification of wastage is different but FAO's figure is not too different from CIPHET.

Table 6.1: Comparison with alternative Estimates cited (% of previous year's net production)

Year	2007	2009-10	2003-04 to 2009-10 (avg)
Category/ Source	KPMG-MoFPI-FICCI	FAOSTAT	Our
Fruits & Vegetables.	2.2	0.19	1.1*
Milk**	35	49.49	11.64**
Meat	21	0.14	5.67
Poultry Products	6	*not reported*	2.05 (eggs)
Milled cereals	-	0.246	4.24

Sources: KPMG, FICCI, MOFPI (2007); computed from FAOSTAT (website 2013) and ASI unit level data, MoA. Note: * 2.13% if only select items are considered. ** KPMG-MoFPI-FICCI specified as Milk & Dairy, FAOSTAT as whole Milk and our estimates is for fresh milk only to avoid over counting. FAOSTAT and our estimates as expressed as percentage of net production accounting for seed feed and wastage. The method of estimation is not clarified in KPMG study.

Milk products or dairy products such as butter, paneer, khoya, cheese are in practice output of milk processing although they are likely to appear as inputs in many processing activities. The method of managing the complexity by other agencies is not clear. While we have considered only 'fresh' milk as the input to preempt over-counting, KPMG et al study has probably reported dairy products (specified variously as milk dairy, milk and milk products, Milk etc.). FAOSTAT reports from groups Whole Milk, Milk excluding butter and skim Milk separately. NDDB (NDDB, 2009) provides an another estimate of milk processing ('butter, milk powder and western type manufactured products') at 15% of the traded milk which again is 50% of milk produced. Constituting less than 8% of total milk, this estimate is lower than our estimate of 11.4%. NDDB also maintains that 35% of traded milk i.e., 17.5% of total milk is consumed in the form of 'traditional products' without further elaboration. There is no evidence to suggest that these products are processed only by informal manufacturing units rather than by farmers, traders or even the consumers. It follows from this decomposition by NDDB that between 8%

and 25% of fresh milk is processed to any milk product including powder and traditional dairy items.

6.6. Summary

On the whole, the linkage between agriculture and industry as reflected by our estimates appear promising though still very weak. In other words there remains considerable potential for enhancing the extent of food processing and strengthening the linkage. Maize among the cereals, marine products among fish, buffalo meat among meat, mango among fruits stand out in the extent of processing. Also, a small amount of grains and oilseeds are milled by food processors in the manufacturing sector although in principle, nearly all of them need to be milled for consumption. Only promotional policy and financial incentives to the industries are not enough to strengthen the link. The government's procurement policies and preference for promoting milling as a service activity versus manufacturing are important influences on the linkage. Commercialization of the rural sector and market orientation of farming and farm households, non-farm employment generation, wastage reducing practices, trade-relations and policy with respect to partner countries and traded products are some other factors that can also shape this linkage.

Table 6.2: Average Extent of Processing of Agro-products% (Exhaustive of 12 subgroups) in the Organized sector, Unorganized sector and Combined sector (Organized and Unorganized)

	Weighted by Production Quantity		Weighted by Production Value	
Sector	2005-06	2010-11	2005-06	2010-11
Total Economy	5.34	5.43	6.42	6.76
Organized Sector	5.01	5.15	6.03	6.42
Unorganized Sector	0.33	0.28	0.39	0.34

Source: ASI, NSS unit level data, MOSPI (CSO), MoA data. Unweighted or Production Quantity-weighted average is the sum total quantity processed divided by total net quantity produced in agriculture. Quantity is measured in weight. Value-Weighted average is the average of the extents of processing weighted by the shares of the sub-groups in the total value of output produced. The values of output are at 2004-05 prices. The 12 sub-groups considered are milled coarse cereals, milled rice, milled wheat, milled pulses, fruits & vegetables, spices, groundnut, soyabean, meat, fish, milk, eggs.

The task of providing a summary glimpse at the agriculture-industry linkage is confounded by the heterogeneity of products and additive difficulties. We attempt to measure the average extent of food processing in India considering 12 sub-groups excluding basic processing and the processed products oils and sugar as inputs. The first measure is the unweighted average in which case the physical weights are treated uniformly as the measurement of amounts (total quantity processed of all covered items divided by net total quantity produced). The second measure is the weighted average which essentially imposes greater significance on the value rather than the physical weight as in the earlier average. This is the weighted average of the extents of processing using the proportions of different items in the total value of production as weights.

By the unweighted average, the extent of processing of agro-products was 5.34% for both sectors combined and 5.01% in the organized sector in 2005-06 but was higher at 6.4% and 6.03% if the weighted average is considered relevant. The extent of food processing went up by all measures but only by a small margin. Using the weighted average, 6.8% of agro-products was processed in 2010-11 and all this mostly in the organized sector (Table 6.2).

Undoubtedly, there is scope for moderation and improvement of the estimates because the assumptions and specifications are rigid, presumptive and sometime subjective. However, another serious hindrance to the analysis was the inadequacy of data of the right quality. Over time, as NSSO and CSO move towards reporting codes, units and data with more care and user friendliness the need for making assumptions and projections will diminish. The secondary data based assessment can be supplemented with primary data obtained mostly by interacting with processors both in the registered and unregistered sector. Not of less importance is the need for internal consistency across official data sources on production, consumption, storage, trade, marketing and processing. This is essential for assuring the data user of the credibility and reliability of the data and estimates.

Bibliography

1. Abbott, John C. (1994). Agricultural Processing Enterprises: Development Potentials and Links to the Smallholder. International food Policy research institute.
2. Antle, John M. (1996). Efficient Food Safety Regulation in the Food Manufacturing Sector. *American Journal of Agricultural Economics*, Vol. 78(5), December, PP:1242-1247.
3. Bathla, HVL, Rai, A, Chaturvedi, AK and Ahmed, T (2005). Pilot sample survey for assessment of harvest and post harvest losses. Final Report of the NATP Project, IASRI, New Delhi.
4. Baviskar, Amita. (2010): "Food, Agrarian Environments and Eating Practices", The Cambridge Companion to Modern Indian Culture.
5. Behera, Amiya Kumar (2004). Rural-Based Food Processing Industry, Report of the APO Multi-Country Study Mission on Rural-Based Food Processing Industry ©APO, ISBN: 92-833-7026-0, The Agricultural Promotion and Investment Corporation of Orissa Ltd. Orissa.
6. Bhavani, T. A., A. Gulati, and D. Roy. (2006). Structure of the Indian Food Processing Industry: Have Reforms Made a Difference?. In Plate to Plough: Agricultural Diversification and Its Implications for the Smallholders in India, submitted to Ford Foundation by the International Food Policy Research Institute. Washington, DC.
7. Birthal S. Pratap, P. K. Joshi, and A. V. Narayan (2013). Agricultural Diversification in India: Trends, Contribution to Grown and Small Farmers' Participation. Edited book by Marko Ferroni, *Transforming Indian Agriculture INDIA 2040 Productivity, Markets, and Institutions*. Sage Publication New Delhi, PP: 89.
8. Business Line, 2014 (a). Proposed cut in levy rice procurement comes as a dampner. The Hindu, October 20.
9. Business Line, 2014 (b). FCI should procure rice, not paddy. The Hindu, June 5.
10. Butz, P., Edenharder, R., Fernandez Garcia, A., Fister, H., Merkel, C., & Tauscher, B. (2002). Changes in functional properties of vegetables induced by high pressure treatment. *Food Research Institute Studies*, 35, PP: 295−300.
11. Cardello, A. V. (2003). Consumer concerns and expectations about novel food processing technologies: Effects on product liking. *Appetite*, 40 (3), PP: 217−233.
12. Central Institute of Post-harvest Engineering and Technology (CIPHET), (2010). Project on Post Harvest Technology, Ludhiana Punjab, Report submitted to Ministry of Agriculture, Government of India.

13. Central Statistical Organisation (CSO), (1998, 2004, 2008). National Industrial Classification (All economic activities). Ministry of Statistics and Programme Implementation, Government of India.

14. Chayanov, A. V., 1966, The Theory of Peasant Economy, ed. and introd. By Daniel Thorner, Basile Kerblay and R. E. F. Smith, Homewood, Ill
15. D'Essence Consulting, (2009). White Paper on Food and Food Processing Industry in India. Mumbai.
16. Davis, J. H., & Goldberg, R. A. (1957). Concept of agribusiness.
17. Directorate of Marketing & Inspection (DMI), (2005), Abstracts of Reports on Marketable Surplus and Post-Harvest Losses of Foodgrains in India. Ministry of Agriculture, Government of India. http://agmarknet.nic.in/AbstractReportsSurplus.htm
18. Diwakar, GD, Gupta, OP, and Singh, DV (1983). A study of estimation of losses in food grains caused by rats. *Journal of Indian Society of Agricultural Statistics*, 31(1), PP: 76-78.
19. Doshi. S.L. (1995). *Anthropology of food and nutrition*. Jaipur/New Delhi: Rawat Publication.
20. FAOSTAT (website). Food and Agriculture Organization of United States. http://faostat.fao.org/
21. Food and Agricultural Organisation (FAO), (1980). Assessment and collection of data on post harvest food grain losses. Food and Agricultural Organisation Economic and Social Development Paper No. 13, Rome.
22. Food and Agricultural Organisation (FAO), (1986). The ICS users' manual. Interlinked Computer Storage and Processing System of the food and agricultural commodity data, by the Economic and Social Policy, Department, Statistics Division (comp.), Rome. 206.
23. Food and Agricultural Organisation (FAO), (1996), "Definition and classification of commodities", Draft report.
24. Fox Tim and Cheng Fimeche (2013), Global Food: Waste Not, Want Not, Institute of mechanical Engineers, London, January
25. Ghosh Nilabja and B Guha Khasnobis (2008). Measuring the Efficacy of Targeted Public Programmes: Public Works Programmes in India. Edited book by Guha Khasnobis, Acharya and Davis *Food Security Indicators, Measurement, and the Impact of Trade Opennes.* ICSSR, UNU-WIDER and FAO, Oxford University Press.
26. Ghosh, Nilabja (2013_a). Impact of Emerging Marketing Channels in Agricultural Marketing-Benefit to Producer-Seller and Marketing Costs and Margins of Agricultural Commodities. Draft report submitted to Ministry of Agriculture.

27. Ghosh, Nilabja (2013$_b$) "Promoting Entrepreneurship among Women in Agriculture" Book (Eds.) by S. Banerjee and A. Chakrabarti, *Development and Sustainability: India in a Global Perspective*, Springer 2013
28. Gokarn Subir & Gunjan Gulati (2006). India: Country Growth Analysis. Asian Development Bank.
29. Goldar, Bishwanath (2004). Indian Manufacturing: Productivity Trends in Pre- and Post-Refrom Periods. *Economic and Political Weekly*, Nov. 20, PP: 5033-42.
30. Gopinath, Munisamy, Daniel Pick and Utpal Vasavada, (1999). The Economics of Foreign Direct Investment and Trade with an Application to the U. S. Food Processing Industry. *American Journal of Agricultural Economics*, Vol. 8 (2), May, PP: 442-452.
31. Government of India (GOI$_a$) (various). Handbook on Fisheries Statistics. Department of Animal Husbandry, Diarying and Fisheries, Ministry of Agriculture.
32. Government of India (GOI$_b$) (website). AGMARKNET. Directorate of Marketing & Inspection (DMI), Ministry of Agriculture, http://agmarknet.nic.in/index.html
33. Gupta, Neha (2013). Government intervention in grain markets in India: Rethinking the procurement policy. Working paper No. 231, Centre for Development Economics, Department of Economics, Delhi School of Economics Delhi.
34. Holand, David, Eugenio Figueroa B. and Jorn Gilbert (2001). The role of Agriculture and Food Processing in the Chilean Economy: Results from an input-output analysis. *Estudios de Economia*, Vol. 28 (2), December, PP: 293-308.
35. Hughes, W. David and Vaneska N. Litz (1996). Rural-Urban Economic Linkages for Agriculture and Food Processing in the Monroe, Louiana, Functional Economic Area. *Journal of Agricultural and Applied Economics*, 28 (2), PP: 337-355.
36. IASRI, (1975). Report on pilot sample survey for estimation of crop losses in storage, Aligarh district (Uttar Pradesh-India) 1973-1974. Indian Agricultural Statistics Research Institute, New Delhi.
37. Ioffe, Grigory and Tatyana Nefedova, (2001). Russian Agriculture and Food Processing: Vertical Cooperation and Spatial Dynamics. Europe- Asia Studies. Vol. 53 (3), PP: 389-418).
38. Kakaty, Gautam and Debajit Borah (2011), "Impact of Emerging Channels in Agricultural Marketing – Benefits to Producer-Seller and Marketing Costs and Margins of Orange and Potato in Assam," Agro-Economic Research Centre for North East India, Assam Agricultural University, Johrat, Assam.
39. KPMG, ASSOCHAM (2009). Food Processing and Agri business.

40. KPMG, FICCI, MOFPI (2007). Processed Food and Agribusiness, Opportunities for Investment in India.
41. Kumar, Ganesh, A., M. Panda and M. E. Burfisher. (2006). "Reforms in Indian Agro-processing and Agriculture Sectors in the context of Unilateral and Multilateral Trade Agreements". Report submitted to the Economic Research Service / United States Department of Agriculture, Washington, D.C., Working Paper 2006-011, Indira Gandhi Institute of Development Research, Mumbai.
42. Kumari Anita, Nilabja Ghosh and Rajeshwor M. (2012). Structural Changes in Indian Agriculture: Using the Theil-Tornquist price Index. Un-publish paper, Institute of Economic Growth, New Delhi
43. Lambert, Ian (2001). Problems and Constraints to the Development of the Agro-Processing Sector. http://www.cavehill.uwi.edu/BNCCde/dominica/conference/papers/Lambert.html
44. Lancaster PA, Ingram JS, Lim MY, and Coursey DG (I 982). Traditional Cassava- based Foods: Survey of Processing Techniques. *Economic Botany* 36 (1): PP:12-45.
45. Liu, Evid, Daniel Taylor and Susan Zhang (2007). China, Peoples Republic of Food Processing Ingredients Sector Food Processing 2007. USDA Foreign Agriculture Service, GAIN Report.
46. Mehta, Rajesh and R. G. Nambair (2008). The poultry industry in India. Presented in Conference on Poultry in 21st Century. Bankok, 5-7 Novmenber, Agriculture Department Animal Production and Health Division. assessed link: http://www.fao.org/ag/againfo/home/events/bangkok2007/docs/part1/1_5.pdf
47. Ministry of Agriculture (MAO_a) (Various), *Agricultural Statistics at a Glance*, Directorate of Economic and Statistics, Department of Agriculture and Cooperation, Government of India.
48. Ministry of Agriculture (MAO_b) (Various), *Indian Horticulture Database*, National Horticulture Board, Government of India.
49. Ministry of Agriculture (MOA_c) (Various), *Agricultural Prices in India*, Directorate of Economic and Statistics, Department of Agriculture and Cooperation, Government of India.
50. Ministry of Agriculture (MOA_d), Directorate of Economics and Statistics, Department of Agriculture and Cooperation (DES), Government of India. http://eands.dacnet.nic.in/.
51. Ministry of Agriculture (MAO_e) (website), National Horticulture Board, Government of India. http://nhb.gov.in/
52. Ministry of Food Processing Industries (MOFPI) (2012), "Data Bank on Economic Parameters of the Food Processing Sector", New Delhi. http://mofpi.nic.in/images/File/DataBank_SectoralDatabaseFPIs_140212.pdf

53. Ministry of Science and Technology (MST), (2004). Report on Food Processing industries. Department of Science and Industrial Research. http://www.dsir.gov.in/reports/ittp_tedo/agro/AF_Animals_Fisheries_Intro.pdf http://www.dsir.gov.in/reports/ittp_tedo/agro/AF_Animals_Meat_Intro.pdf
54. Morrison, J. Catherine (1997). Structural Change, Capital Investment and Productivity in the Food Processing Industry. *American Journal of Agricultural Economics*, 79, February, PP: 110-125.
55. Murthy, Raja (2010). India outsources food-waste woes. Asia Times, July 21.
56. Narain, P. and Khosla, R. K. (1984). Estimation of post-harvest foodgrain losses. *Journal of the Indian Society of Agricultural Statistics*, 36 (1), PP:127. ISSN 0019-6363
57. National Sample Survey Organisation (NSSO), (2008). Unorganised Manufacturing Sector In India, Employment, Assets and Borrowings. NSS 62nd Round, (July 2005-June 2006), Report No. 525(62/2.2/2).
58. National Skill Development Coperation (NSDC), (2010). Human Resource and Skill Requirment in the Food Processing Sector (2022). A Report.
59. National Dairy Development Board NDDB, (2009). Base working paper on Strategy and Action Plan for Ensuring Safety of Milk and Milk Products. www.fsssai.gov.in/portals/0/baseworkingpaper_june2009.pdf. Expert group on milk and milk products.
60. Neogi, Chiranjib and Buddhadeb, Ghosh (1998). Impact of Liberalisation on Performance of Indian Industries: A Firm Level Study. *Economic and Political Weekly*, Vol. 33 (9), (Feb. 28-Mar. 6), PP: M16-M24.
61. Rao, G. Gangadhara and G. M. Jeelani, (2011), "Impact of Emerging Channels in Agricultural Marketing- Benefits to Producer-Seller and Marketing Costs Margins of Agricultural Commodities," Report No. 132, Agro- Economic Research Centre, Visakhaptanam Andhra Pradesh.
62. Robison, M. H. and N. L. Meyer (1992). The Role of Rural Industry in Idaho's Cities. *Idaho Economics Series*, No. 1 (3), Cooperation Extension System, Department of Agricultural Economics and Rural Sociol, University of Idaho, Moscow, June.
63. Schmidt, Ronald H. (1997). Basic Elements of Equipment Cleaning and Sanitizing in Food Processing and Handling Operation. Cooperative Extension Service, Institute of Food and Agriculture Sciences, University of Florida, Fact Sheet FS 14.

64. Sharma, R. K and Seema Bathla (2012). Research Study on Economic and Social Viability of Agro-Processing Industries in India. African-Asian Rural Development Organisation (AARDO).
65. Singh, Ranveer, C. S. Vaidya, Meenakshi and Pratap, Singh (2011), "Impact of Emerging Channels in Agricultural Marketing- Benefits to Producer-Seller and Marketing Costs and Margins of Apple and Tomato in Himachal Pradesh," Agro Economic Research Centre, Himachal Pradesh University, Shimla.
66. Sun, Da-Wen (2007). Computational Fluid Dynamics in Food Processing, CRC Press / Taylor & Francis, Boca Raton, Florida, USA, PP: 740, ISBN 978-0-8493-9286-3.
67. Wanjari, OD, Vishwakarma, RK, Gupta, RK and Thakur, AK (2005). Pilot sample survey for assessment of harvest and post harvest losses of oilseeds. Final report of the NATP Project, CIPHET, Ludhiana, India.
68. Wikipedia (website). http://en.wikipedia.org/wiki/Main_Page

Appendix 1

A1.1: Residual method for reconciling data on product disposition using consumption data

Table A1.1: Residual after disposition of products (2009-10)

Fruits	%	Vegetables	%
Mango	75.25	Tomato	5.41
Apple	28.08	Onion	-16.41
Papaya	45.96	Potato	26.58
Banana	57.00	Tapioca	81.50
Guava	46.16	Brinjal	18.99

Note: The method was suggested by MOFPI. Source: Calculated using data from NSSO, census data MOA data.

In 2009-10 mango production in India was reported as 15.03 million tonnes. On the disposition side consumer survey of the NSSO for the same year reveals that household per capital consumption of fresh mango was 0.108 Kg and 0.158 Kg in the rural and urban sectors respectively. With the two sectors' population presumed as 808 and 363 million (making up 1.17 billion) the total household consumption works out to be only 1.74 million tonnes in the economy. Imports were minimal but India exported 0.075 million tonnes of fresh mango although a larger amount 0.188 million tonnes of mango was exported as pulps. Of the production an estimated 12% was subjected to post-harvest loss (as provided by CIPHET) leaving 11.3 million tonnes of surplus after adjusting for wastage and external trade (11.1 million tonnes if mango pulp export is considered also) and deducting consumption of unprocessed mango at the household level. Constituting 75% of the production, this gap is way more than our estimates of food processing obtained using ASI and NSSO data for any reconciliation. It is known that the horticultural data of the Ministry is a new initiative still under evolution but the production data is understood to be of the harvested product exclusive of spoilage and maturation on or under tree and that the wastage data reported by a survey is reliable and takes account of spoilage at various stages of marketing including at retail. There is also an underlying assumption that there is no change in stocks which is reasonable given the perishable nature of the products. Even if small portion (say 6%) is presumed to be set aside as seed the discrepancy is hardly eliminated. Similar estimates for a few other specified

products (Appendix Table A1.1) give debatable results in all cases except tomato. The exercise only highlighted further need to strengthen and clarify the official data protocols.

Appendix 2

A2.1: Estimates for India from alternative sources

Table A2.1: Level of Processing: India

Level	Organized Sector %	Unorganized Sector %	Total
Fruits & Vegetables	1.2 (1.3)	0.5 (0.8)	1.7 (2.1)
Dairy	15.0 (13.0)	22.0 (22.0)	37.0 (35.0)
Meat	21.0 (21.0)	-	21.0 (21.0)
Poultry	6.0 (6.0)	-	6.0 (6.0)
Marine fish	1.7 (8.0)	9.0 (15.0)	10.7 (23.0)
Shrimps	0.4	1.0	1.4

Source: APEDA, MOFPI, Eeksporttilindien, 2009. Figures in bracket are estimates from D'Essence Consulting, (2009)

A2.2: **Estimates for different countries using FAO data**

Table A2.2.1 Share of available agro-products processed in developing countries (%) based on FAOSTAT-FBS

Crops		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Milled Cereals	Brazil	6.90	6.71	6.63	6.26	6.53	6.75	7.04	7.32	8.32	8.51
	Thailand	4.55	4.26	4.05	4.83	5.77	5.26	6.19	6.03	6.23	5.67
	China	2.08	2.13	2.16	2.22	2.53	2.75	2.97	3.10	3.29	2.91
	Malaysia	2.00	2.10	2.19	2.12	2.21	2.22	2.30	2.47	2.30	2.34
	Phillipines	1.49	1.47	1.49	1.45	1.43	1.40	1.42	1.36	1.34	1.41
	India	0.24	0.24	0.22	0.21	0.23	0.22	0.22	0.23	0.25	0.26
Fruits	China	8.35	7.58	7.78	7.68	7.37	7.28	7.01	6.97	6.70	6.24
	Brazil	2.25	2.83	2.25	2.10	2.92	2.48	1.67	2.42	2.41	2.17
	Thailand	0.72	0.82	0.77	1.04	1.17	1.25	1.29	1.13	1.41	1.49
	Malaysia	0.01	0.01	0.64	1.15	1.12	1.14	1.26	1.28	1.23	1.25
	India	0.43	0.39	0.41	0.40	0.39	0.27	0.47	0.47	0.47	0.46
	Phillipines	0.44	0.47	0.30	0.35	0.33	0.33	0.37	0.23	0.21	0.20
Oil crops	Malaysia	91.25	91.87	91.63	94.38	94.22	94.76	95.45	94.44	94.53	96.09
	Brazil	90.19	90.26	88.53	89.16	88.89	88.4	88.22	88.63	88.32	89.58
	China	81.94	83.42	85.15	86.65	86.76	87.03	88.52	88.36	88.40	88.82
	Phillipines	76.97	81.44	76.46	79.81	79.71	79.12	80.08	71.70	71.35	70.66
	India	77.24	75.49	72.86	76.12	77.29	78.99	75.12	77.05	77.73	76.30
	Thailand	43.94	44.22	45.72	41.33	46.30	47.92	52.83	50.74	51.70	55.95
Sugar crops	China	99.81	99.86	99.87	99.89	99.93	99.93	99.94	99.95	99.95	99.95
	Brazil	99.37	99.71	99.72	99.74	99.51	99.52	99.47	99.50	99.54	99.55
	Phillipines	99.50	99.52	99.56	99.57	99.57	99.54	99.51	99.57	99.57	99.17
	Thailand	99.32	99.18	99.45	99.51	99.44	99.35	99.17	99.43	99.46	99.33
	India	96.14	96.06	96.18	96.17	95.27	95.65	95.65	98.91	96.38	95.86
	Malaysia	92.94	93.23	92.42	91.29	90.61	90.67	90.94	90.89	89.64	89.51

Note: The countries are ranked by the average extents of processing in the year 2000 to 2009. Source: Computed using FAO's Food balance sheet (FBS) data.

A2.2.2: FAO data features and Complications

While working with the FAO data for the purpose, there may be several questions on the reliability of these estimates. The FAO data is a compilation based on the raw data which is availed from different countries with their own understanding, protocols and political stands on sensitive food related issues. The basic data have been supplied by governments through national publications and FAO questionnaires (both paper and electronic). Moreover, FAO states that to make the coverage of this data collection as complete as possible, official data have sometimes been supplemented with data from unofficial sources. Use has also been made of information supplied by other national or international agencies or organizations. This data domain contains production data for primary products. Thus the cooperation of governments is a critical precondition and qualitative adequacy of the compilation of the data. FAO has continued to collaborate with various agencies in order to achieve conformity in the presentation of international figures.

Even with the collaboration, tying international data in a uniform framework has been a challenging task. Certain vegetable crops are not always cultivated for human consumption and the same has been deleted in relevant countries if explicitly grown as animal feed. Statistics on vegetables are not available in many countries, and the coverage of the reported data differs from country to country. In general, 'it appears' that the estimates refer to crops grown in field and market gardens mainly for sale, thus excluding crops cultivated in kitchen gardens or small family gardens mainly for household consumption. In certain countries production from family and other small gardens not included in current statistical surveys constitutes quite an important part of the estimated total production. For these reasons, continental and world totals are far from representative of the total production of the different kinds of vegetables. Statistics on fruit, especially tropical fruit, are unavailable in many countries, and where reported they often lack uniformity. Generally, production data relate to plantation crops or orchard crops grown mainly for sale. Data on production from scattered trees used mainly for home consumption are not usually collected and production from wild plants, particularly berries is generally disregarded by national statistical services.

Finally, time reference for statistics on area and crop production is based on a calendar year. That is to say, the data for any particular crop is reported under the calendar year in which the entire harvest or the bulk of it took place. This does not necessarily mean that for a given commodity the production data are aggregated month by month from January to December, although this is true for certain crops which are harvested almost uniformly throughout the year. Production of these crops is reported by the various countries in different ways: by calendar year, agricultural year, marketing year, etc. Whatever the statistical period used by the countries for presentation of area and production data, these data are allocated commodity by commodity to the calendar year in which the entire harvest or the bulk of it took place. Obviously, a crop that is harvested at the end of the calendar year will be utilized mostly during the year following the calendar year under which the production figures are reported. It should be noted that the adoption of a calendar-year time reference period inevitably means that, in a number of cases, crops assigned by countries to a particular split year may appear under two different calendar years.

Appendix 3
Food Processing potentials of India

A 3.1. Cereals

In India cereals constitute the lion share of agricultural production accounting for 50% of the area under crops. The cereals are mostly consumed as staples after simple cooking procedures and in some cases moderate primary processing of the product to remove the husk is indispensable. Traditionally, this processing service is obtained from local millers but consumers are increasingly purchasing milled grains, often in packaged and branded forms. The transformation of the grains of cereals involves intense processes like cleaning, drying, soaking, germinating, milling, de-vegetating and mixing with other ingredients like milk. In a limited way cereals can also be amenable for further value addition into nutritious, consumer friendly or attractive food. Wheat, apart for its direct consumption in households after domestic transformation to items like chapatti and puri is widely known to be an ingredient for commercially processed bread and other bakery and confectionery items. Besides, with Indian diet encountering influences from western practices and shortage of time becoming a constraint breakfast cereals are becoming common and are likely to become even more popular. Although maize or corn is a major item being flaked for breakfast consumption, wheat and even rice flaking for the same purpose is not uncommon now.

Food habits are cultural aspects of peoples and in a diverse country as India, the kind of food consumed and the way the food is transformed from its raw form is also varied. However due to growing affluence, the influence of information dissemination, increased physical mobility of people in keeping with economic dynamics, food habits are fast getting distributed spatially, This means that the preparations traditionally preferred in certain specific regions are in demand in other regions both owing to the presence of disparate communities and because of rising interest among local communities to induct variety in the food basket. Moreover, the exchange is not confined only to intra-country dimensions but foreign food from overseas also arouse interest among the people perhaps with some modification. Staples are consumed in different forms by different communities. It is not unusual to find different semi-processed concoctions or ‘mixes’ for ethnic cuisines in the shelves of supermarkets and retail stores. Thus mixes and semi-processed ingredients of dosa, idly, noodles, pasta, cakes and pizzas are examples of easy

to prepare food materials now in display in attractively packages for consumers manifesting processing of raw cereals rice and wheat for further action at the household level before consumption.

The possibility of processing coarse cereals is significant. As things are, coarse cereals commonly grown in arid regions of the country have dwindled in popularity in consumer preference and thereby in the agricultural production patterns and given way to rise and wheat. They were started to be seen as poor man's feed that even as such felt the assault of the public distribution of subsidised rice and wheat that are easier to cook in the household. The transition has not been seen with uniform acclaim as critics found merit in growing the cereals both ecological benefits and their nutritional value. With the emergence of dairy as an viable economic activity and ingress of technology, there are signs of a possible resurrection of the grains already on the wane. They can be processed into various health foods (nutria-mix), biscuits, malt for beverages and snacks after popping or flaking. Research on food processing can generate other innovative products with potential demand. Besides, the coarse cereals have a major end use as animal feed. Sophisticated mechanization claims to assure speedy and efficient processing and provide an impetus to the capital goods sector. Quality control over raw materials selection, nutrient conservation, cleanliness and hygiene are essential components of the processing. Coarse cereals especially millets are raised in dry and unirrigated regions that are often associated with poverty and these crops are rapidly losing out in producer's choice because of the low prices fetched. Processing can go a long way in exploiting the potentials of these nutritious grains to benefit the disadvantaged regions and develop them.

A 3.2. Pulses

Pulses are daily items of consumption in Indian food habit, eaten cooked with cereals or as sprouted and are an important source of protein and energy. All the items under the sub-groups Pulses are also subject to moderate processing. A large part of their processing involves, loosening of husk, preserving, oiling, cleaning, drying and packaging for final home use. Pulses are processed in industries and cooked in the kitchen both as milled and unmilled grains. Although they are cooked at home, the processors take charge of checking the quality of materials and ensure compliance with food quality standards. Airtight scientific packing with professional expertise to preserve the aroma and freshness with a long shelf life is a value addition. The quality of the raw material in turn depends on location, method and time of cultivation bur machines and techniques are developed to sort materials and to preserve nutritional value. Many salted snacks (namkeens) have different pulses as ingredients. Moong dal roasted is a popular snack. Urad is

used as a major component in south Indian food like Idli, Bada and Dhosa mix. Papad or Papadam is a popular accompaniment of food and beverages.

A 3.3. Oils and Oilseeds

Oil is used in most culinary preparations in domestic or commercial domain. However the demand for oil is encountering significant modulation in response to scientific understanding of biological implications. India produces nine major oilseeds, rapeseed mustard being a major element but on the whole India fall short in the production of oilseeds and extraction of oils from oilseeds and resorts to imports. Imports of palm oil are common but recently imports of soyabean are gaining significance. Moreover, some of the oils are further processed into refined oils. Interestingly many oilseeds also have other uses and processing possibilities apart from oil. Animal feed is one such product and with the rise of the livestock sector, processing of feed tends to gain importance. Although oilseeds require only primary processing to become oils, value addition is possible not only on oils to produce other and nearly all food products but oilseeds themselves can be processed to products other than oils. Thus groundnut can be processed to tasty peanut snacks and sweet chikkis and rapeseed and mustard to sauce and kasundi. Soyabean has wider use as nuggets, granules, soy-milk, sauce and soyabean as packaged products for home consumption.

A 3.4. Fruits and vegetables

Fruits are rich in minerals and vitamins. It is believed that they are best consumed fresh but due to damages imposed by transit and the improvement of processing techniques, sometimes processed products are found to be nutritionally superior to the average raw products available in market. In any case, both fruits and vegetables are highly perishable and processing is the only way to ensure consumption across the year. This is the reason why since ancient times various products like jam, jelly, pickling and squash are made by preserving juice of fruits so that they can be consumed during off season as well.

Horticulture is a emerging sector in India and although fruits and vegetables are preferred fresh by most consumers there is also immense possibility of processing these products both for providing added nutri-supplement and taste to the consumer and to make the maximum use of the country's produce. Modern food habit is also generating demand for new products like sauce, ketchups and juices as meal

accessories. In India horticultural products always enjoyed significant demand but received little policy emphasis. Therefore, although the production potential is also considerable in India, no effort was made to commercialise, modernise and develop the horticulture sector so that wastages due to damage and degeneration are reduced, the nutritional content of these crops reaches the average person and the growers benefit economically. Many regions in India, in particular the hilly regions of Himalayas and in the northeast have distinct advantage in growing fruits but as transit is difficult, investment is needed to be directed for refrigeration, transportation and onsite processing.

Although all fruits and vegetables can be processed, the possibility of commercial processing depends on the demand for the products in processed form, whether the products can withstand the temperature and pressure to which they are subjected to and how regular is the supply of the raw materials. Certain fruits are more tasty and nutritious when eaten fresh but the same product may not be suitable for processing. The same fruit or vegetable may be suitable both for processing and fresh consumption but at different stages of the ripening period. The location of the plant with respect to growing areas, transport facilities and the flexibility of the equipment to handle varied products throughout the year and above all the expertise and technological empowerment are important considerations for the viability of the processing.

In particular vegetables are generally taken commercially unprocessed when home cooked. However it is possible to process many vegetables in diverse categories of roots, stems and leafs. Potato is becoming popular ingredient for many snack foods like chips and bhujias and dehydrating potato has seen technical advancements. Tapioca is widely used for making traditional health product sago. Tomato juice, sauce and pastes are popular for which pulping is an essential step. For processing fruits and vegetables, scientific methods of determining the level of ripening, removal of defects, washing, cleaning, grading, peeling, juice extraction, seeding, preservation and sterilization are some of the steps taken for generating clean and attractive products and many of these operations can be mechanized. Fruits extracts are used for flavouring other food and non-food items. Fruits and vegetables also become ingredients of beverages like fruit drinks and squash, medicines (vitamins). Compliances with the provisions under the FPO and PFA Act is important for success especially in the export market.

A 3.5. Spices

Careful monitoring is needed right from the stage of growing spices in environmentally safe manner, possibly with organic methods. Harvesting needs to be done carefully with skill and the processing

involves sweating, drying and polishing in hygienic ways to avoid adulteration at any stage and eliminate toxicity and contamination. Traditionally, spices were crushed by stone equipment at home but increasingly ready to use powdered spices in packed as available for sale. Grinding spices and packaging constitute major components of processing spices. Besides spices are also used as accessory ingredients of food products in which the main raw material is another agricultural item. Spices can also have medicinal uses.

A 3.6. Milk

Milk is one of most widely recognized agro-product amenable for processing related to a large variety of dairy products like butter cheese, paneer, health drinks. Pasteurising milk is a common and almost compulsory method of making milk fit for consumption. Variations of milk in terms of fat content and as powdered dry or as liquid are used by consumers and processor. Milk and the intermediary milk products also as ingredients for many non-dairy products like chocolates, cakes, biscuits, Ice-cream, yoghurt, shakes and other drinks and desserts are also final products of milk processing activities.

A 3.7. Meat, Egg and Fish

India has a large livestock population including 205 million cattle and 90 million buffaloes. Poultry meat has a large market in the country. India's free ranging, steroid and fat-free meat is winning worldwide acceptance as research stations, veterinary centres rise to the challenge of meeting the stringent quality checks and global standards. Malaysia, UAE, Philippines, Iran and Oman import meat from India. India targets bulk customers but branded products in consumer packs also find a place in super markets overseas. India however has a large population culturally vegetarian population. Most Indians do not eat beef. The fish eating and meat eating population also has a preference for fresh products.

In the global perspective India's livestock population is the largest among all nations but although meat is consumed in the country where such consumption is permitted by religion and culture within the country as also exported. Mutton and Buffalo constitute much of the exports. Buffalo meat which accounts for 70% of the meat export from India is surplus in India.

There are 600 municipal slaughter houses in the country but there is vast scope of improving the slaughtering facility. However the slaughter rate of bovine animals is low whereas it is high (38%) in the

case of sheep and goat. Only a small portion (1% according to MST, 2004) of the meat produced is converted to value added products like sausage, bacon, luncheon meat, kebabs, meat balls. Major meat products in India are listed as frozen and packed meat, poultry in fresh form and egg powder. Exports of processed meat include mostly corned beef although demand for ethnic products like kebab, Gushtaba, Akhani, Korma and European food products like sausages, ham, salami, burger, smoked meat.

Inland waters, coastal waters, deep seas in india's Exclusive economic Zone, the 8041 Km long coastline, 28000 Km rivers and millions of hectares of reservoirs, ponds and brackish water create a vast potential for fisheries from both inland and marine resources. Fishery provides full-time and part-time employment to nearly 6 million people and contributes 1.3% of the GDP. With the varied fish resources and the food habits in the country and in other countries, potentials for processing fish is considerable. India also exports 0.4 million tonnes of processed sea food. World market is characterised by growing demand and tight supplies. The most important fish in the world market are Tuna, Groundfish and cephalopod.

India is in the process of developing its marine fishery sector, with plans for fishery harbours and Fish landing centres. Indian oil sardines, Indian mackerel, Sciaenidae, Bombay duck, anchovies and perches are common catch. Inland fish farming is catching up also with West Bengal, Andhra Pradesh and Bihar being the top three states. Besides fresh water aquaculture (carp, roho, mrigal, Catla, catfish are examples) and brackish water aquaculture also emerged (shrimp, white prawn, tiger prawns are examples). Production suffered a set back due to a ban on intense shrimp farming for environmental reasons. Processing of fish however mostly involves frozen and canned products in fresh form.

Appendix 4

A4.1: Data Sources and details

Table A4.1:Reference periods of Survey ASI and NSSO

Publication	Survey name	Accounting year	reference date	Survey period
ASI data				
2003-04	Annual Survey of Industries 02-03	2002-03	31st March	2003-04
2004-05	Annual Survey of Industries 03-04	2003-04	31st March	2004-05
2005-06	Annual Survey of Industries 04-05	2004-05	31st March	2005-06
2006-07	Annual Survey of Industries 05-06	2005-06	31st March	2006-07
2007-08	Annual Survey of Industries 06-07	2006-07	31st March	2007-08
2008-09	Annual Survey of Industries 07-08	2007-08	31st March	2008-09
2009-10	Annual Survey of Industries 08-09	2008-09	31st March	2009-10
2010-11	Annual Survey of Industries 09-10	2009-10	31st March	2010-11
NSSO Publication				
2008	Manufacturing Enterprises, NSS round 62	2005-06	date of survey	July 2005-June2006
2012	Unincorporated Non-Agri. Enterprises (excl. constructions), NSS round 67	2010-11	Date of survey	July 2010-June2011

A4.2: Concepts and Specifications

A4.2.1: Unit of enumeration and analysis

The nature of economic activity is identified at the level of a unit of activity which is the 'establishment' in this case. The term establishment is defined as an economic unit, which is engaged in one (predominantly one) economic activity at a single physical location under single ownership control of a firm or enterprise (CSO, 1998, 2004, 2008). The firm or enterprise may however have more than one establishments engage in different activities at the same location or the same activity at different locations.

Under the ASI data the primary unit of enumeration is a factory in manufacturing industry, a workshop in the case of repair services, an undertaking or a licensee in the case of electricity, gas and water supply undertaking and an establishment in the case of *bidi* and cigar industries (CSO, 2004). The primary unit of enumeration which is the factory is defined as any premises including precincts where (i) 10 or more workers are working (or were working in any day of the proceeding 12 months) with the aid of power and (ii) where 20 or more workers are working without the aid of power.

For the NSSO data the unorganized sector enterprise is the unit of enumeration where the enterprise is defined as 'an undertaking engaged in the production and/or distribution of some goods and/or services meant mainly for the purpose of sale, whether fully or partly' (NSSO, 2008). The enterprise may be operated by a single household or by several households jointly on a partnership basis or by an institutional body. The unit is engaged in manufacturing i.e., in chemical or physical transformation of materials, substances or components into new products. The units also include those that are primarily engaged in maintenance and repair of industrial, commercial and similar machinery and equipment which are, in general, classified in the same class of manufacturing as those specializing in manufacturing the goods. The units are in the unorganized manufacturing sector consisting of the following types of enterprises: (i) All manufacturing enterprises except those registered under section 2m(i) and 2m(ii) of Factories Act, 1948 and Bidi and Cigar Workers (conditions of employment) Act, 1966. (ii) All manufacturing enterprises except those run by Government (Central Government, State Governments, Local Bodies) / Public Sector Enterprises. The enterprises cover household enterprise, (ii) non-household enterprise, (iii) own account enterprise (without hiring workers on regular basis),

(iv) establishment (at least one hired worker- non-directory and directory), (vi) Perennial, seasonal and casual enterprise.

In interpreting the term 'food' in the title, the emphasis was interpreted to be on items from agriculture which enter as inputs in different industries though the finished output may or may not be edible. Thus the domain of activities is not confined only to the food processing category (NIC code 2004-15) and allows for activities as in chemical processing and pharmaceuticals to find space. However although the items considered are only agricultural in nature, not all farm products could be included. Cotton, jute and other fibre items are not considered as they do not fall in the food category. The study also excludes tea, coffee, cocoa and other intoxicants including tobacco. The conceptualization of food processing as a broader entity and agro processing is discussed in Chapter 1.

A4.2.2: National Industrial Classification

Official Statistical data are required to be collected and presented according to classification designed to facilitate their use for national economic policy and economic comparisons. Comparative statistics available from various sources is a prerequisite for standardization of a system of classification. The CSO, then in the Department of Statistics developed a standard industrial classification (SIC) in 1962, the classification since then was revised from time to time to mop up the significant changes in the organization and structure of industries. The CSO revised the SIC 1962 in 1970 (NIC-70), in 1987 (NIC-87) and subsequently in 1998 (NIC-98).

After 1987, significant revision was necessitated by extensive changes in product mix of enterprise and diversification of industries as well as the release of the United Nations International Standard Industrial Classification (ISIC), 1990. A steering Committee under the Director General of CSO brought out a consolidated report on NIC 1998. The Committee constituted of five subject specific sub-groups to cover all sectors of the economy. The NIC 1998 is identical with the ISIC Rev3 of UN in structure up to the 4 digit level and incorporates both the appropriate 4 digit categories of NIC 1987 and the national requirements in its 5 digit level. Based on the national need the UN ISIC coding was consistently updated in 1998 (NIC-98) and NIC 2004(Rev. 3.1). After release of the UN's International standard industrial classification (ISIC) - 2002 Rev 3.1 another round of revision took place to update the classification to NIC 2004. In 2008 the United National Statistical Commission considered the draft ISIC revision- 4v during the 38th session of UNSC for adoption by all the member

countries. The Standing Committee on Industrial Statistics (SCIS) set up an expert Committee under the Chairmanship of Director General (Nath Committee) of CSO in July 2007 and a draft NIC 2008 was approved in September 2008.

The ISIC is essential for developing a proper statistical system in the country. At the international level the issue was deliberated in the First International Conference of Labour Statisticians, (ICLS), 1923 in which International Labour Organisation (ILO) recommended three broad categories for classifying economic activities namely

i) Primary Production (agriculture and mining);
ii) Secondary Production (manufacturing and construction); and
iii) Services (transport, commerce, administration, etc)

Subsequent Conferences drew up provisional lists of branch of activities and in 1948, the Statistical Commission of the United Nations recommended an International Standard Classification (ISIC) of all activities. The ISIC was to be used both nationally and internationally for classifying data according to the kind of activity. The UN, the ILO, the FAO and other international body utilized ISIC in publishing and analyzing their statistical data. Many countries used ISIC as the basis for devising their own Industrial Classification and attain substantial compatibility. Periodic reviews of the structure and definition took place such as in 1956, 1965, 1979, 1990 and 2002 (Rev -3.1) to have more amplified, clarified or improved classification.

In India, Industrial Classification has been used in Population Census, Industrial Surveys, Labour Statistics, etc. But the Industrial Classification used by the concerned organizations varies. A common classification based on ISIC's framework became urgent and in 1987, the CSO finalized the revision of 1970 within the ambit of ISIC 1968 (Rev. 2). With the advent of ISIC Rev. 3 in 1990 at the international panorama, in order to enfold the changes in the organization of economic activities and to capture the emergence of new activities, it was exigent to review and revise NIC 1987.

National Industrial Classification 1987 (NIC- 87): NIC-87 is a revision of the NIC70 in the ambit of ISIC-1968-Rev2. At the 1-digit level there was no major change from NIC-70 and the economy remained divided into 9 sections. At the 2 digit level the number of divisions expanded to 72 from 64 and the 3 digit categories were also increased from 383 to 461. Further, the 4 digit classification was

introduced throughout in this NIC-97 (the classification was there only for mining and manufacturing earlier) so that the number of categories in the 4 digit group was 918 against 590.

National Industrial Classification 1998 (NIC- 1998): bNIC-98 follows the principles of ISIC Rev. 3. One of the significant features of the NIC 1998 is that apart from being identical with the ISIC Rev. 3 in structure up to the 4-digit level, the appropriate four- digit categories of NIC-1987 and the national requirements have been incorporated at the five digit level. The NIC- 1998 was later updated in 2004 based on ISIC Rev. 3.1.

National Industrial Classification 2004 (NIC- 2004): The NIC-98 was later updated in 2004 based on ISIC 3.1 and a few shadow classifications were only introduced.

National Industrial Classification 2008 (NIC- 2008): This is a revised version of NIC-2004. The 38th session of the UN Statistical Commission recommended the member countries for the adoption of ISIC, Rev. 4. The revised NIC- 2008 is a significant change from NIC-04 and provides a more contemporary industrial classification system. The structural difference is in grouping of the activities since more emphasis on 'relevance' was considered. Changes in structure and composition of the economy, changing user requirements and comparability with international standards have been taken account while developing NIC- 2008. The NIC-08 has 21 sections, 88 divisions (2 digit), 238 groups (3 digit), 403 classes (4 digit) and 1304 (5 digit) sub-classes. The shadow classes (of 2004) have been done away with. Ambiguity in the scope of classification are removed and distinct classification is enabled by 'inclusion' and exclusion' statements in the 4 digit level.

Industrial classification

Food processing is a manufacturing activity and can be represented by the standard classification employed by the Government for policy purposes and for data representation. This is the National Industrial Classification (NIC) made largely in keeping with international norms (the UN-ISIC) while keeping in perspective the national reality and needs. The CSO thus revised the classification as follows:

(i) The SIC1962 was revised in 1970 to NIC-70,

(ii) The NIC 1970 was revised in 1987 to NIC-87,

(iii) NIC-87 was revised in 1998 to NIC-98,

(iv) NIC-98 was revised in 2004 to NIC-2004

(v) NIC-2004 was revised in 2008 to NIC-08.

Moving from the composite groups represented by 2 digit codes, the classification goes into further disaggregation through 3 digit, 4 digit and 5 digit codes. In our case the higher digit codes help us in better in identifying the activities by alternative definitional specifications. Nevertheless, despite the flexibility provided by the 4 digit and the 5 digit codes, the residual rigidity still restrains our ability to isolate specific activities of interest. The intermittent changes in classification also subject us to re-categorize our data by different standards but all effort has been made to maintain homogeneity of the constitution of the group and its sub-groups. In particular we have used NIC-1998 to select and differentiate activities in the years preceding 2004, NIC-04 to select and differentiate activities in the years 2005-06 to 2008-09, NIC-2008 for the year 2009-10 and thereafter.

Food processing is broadly covered by the 2 digit NIC code of 15 by NIC-98 and NIC-2004 and divisions 10 and 11 by NIC-2008. Other industrial activities too consume agriculture-sourced inputs but such activities fall in narrow bands within the respective 2 digit codes and hence require to be represented by larger codes. Even within food processing code (code 15 by NIC2004), some of the activities can turn out to be inconsistent with the specifications we set for ourselves.

Codification of items

The exercise requires that each item of agricultural origin that enters the manufacturing process as an input is identified with precision. This is enabled by the protocol of using a standard system of codes called A Standard Industrial commodity classification or ASICC. The ASICC was developed first by the IS Wing of the CSO with the primary objective of having a uniform non-industry specific input output coding structure. In recent times from the year 2009 the ASICC code has given way to a more internationally compatible system of codes known as National product classification for manufacturing sector (NPCMS). Since our specific interest concentrates on items of agricultural origin, the relevant ASICC varies from 1100 to 1600.

A4.2.3: Annual Survey of Industries for organized sector (Factories)

The Annual Survey of Industries data is provided by the CSO since 1959. Collected by the Field Operation Division of the NSSO and processed and tabulated by CSO-IS Wing Kolkata the survey is coordinated by the ASI Unit of Industrial Statistics Division of CSO at Delhi. The survey, conducted annually under the statutory provision of Collection of Statistics Act, 1953 that replaced the earlier schemes Census of Manufacturing Industries (CMI) and Sample Survey of Manufacturing Industries (SSMI) provides statistical information to 'assess and evaluate objectively and realistically the changes in the growth, composition, structure of organized manufacturing sector'.

Registered Factories

Extending to the entire country it covers all factories registered under the Factories Act, 1948, that is employing 10 or more workers using power and those employing 20 or more workers without using power. The frame is based on the list of registered factory/units maintained by the Chief Inspector of Factory in the states, is regularly updated and also revised every three years. Thus the primary unit of enumeration is the factory. At the time of revision the names of the de-registered factories are removed from the ASI frame and those of the newly registered factories are added. Small factories selected for survey but found nonexistent in the field are deleted and not taken into consideration in the tabulation and analysis. The factories in the frame are classified into two sectors the census and the sample sectors. The census sector covers all industrial units belonging to industrially less developed states and UTs (Manipur, Meghalaya, Nagaland, Tripura and Andaman and Nicobar islands) and in the states only units having 100 or more workers and factories covered under joint returns.

A4.2.4: National Sample Survey data on Unorganized manufacturing Sector in India

While the data for organized manufacturing sector are collected through ASI, the same for the residual non-factory unorganized manufacturing sector are collected periodically through NSS as follow up surveys of economic censuses. The unorganized manufacturing sector has one third share in the total contribution by the manufacturing sector in the GDP. The survey is periodically conducted by NSSO as part of larger surveys. An integrated survey was initiated in the 51st Round in 1994-95 in which unlike in the past (as the 45th Round 1989-90) all types of manufacturing and repairing units are covered. Since 2000, there have been three Rounds of NSSO survey to address this subject namely the 56th Round in 2000-01, 62nd Round in 2005-06 and the latest 67th Round in 2010-11.

The unorganized manufactured sector refers to all manufacturing enterprises which are not covered by ASI. All Government and public sector undertaking are also outside the coverage of the survey. The survey covers the whole of Indian union except Leh and Kargil districts of J&K, interior villages of Nagaland and inaccessible villages of Andaman and Nicobar Islands. Only those enterprises which operated for at least 30 days (15 days for seasonal enterprises) during the last 365 days preceding the date of survey are eligible for survey.

The frame used in NSSO survey is usually based on area frame. The special feature of the sample design adopted during the 62nd round was the use of list frame, in addition to the usual area frame, which was done to capture sufficient number of relatively 'bigger' enterprises with a view to improving the overall estimates. A list of 8,000 big non-ASI manufacturing enterprises for the urban sector only was prepared as per the data of the census of manufacturing enterprise es conducted by Development Commissioner of Small Scale Industries (DCSSI) in 2003. This list served as the list frame. All these units in the list frame were considered for survey without resorting to any sampling. For the coverage of all other enterprises in the universe, the usual area frame approach was followed for sampling of enterprises in stages. It is important to mention that this dual frame approach was experimented for the first time in the 62nd round.

In the 67th Round an all-India enterprise survey on economic and operational characteristics of unincorporated non-agricultural enterprises in manufacturing, trade and other service sector (excluding construction) was carried out. The Unincorporated non-agricultural enterprises included those non-agricultural enterprises which are not incorporated (i.e. registered under Companies Act, 1956). The domain of unincorporated enterprises excluded as in the earlier surveys (a) enterprises registered under Sections 2m(i) and 2m(ii) of the Factories Act, 1948 or bidi and cigar manufacturing enterprises registered under bidi and cigar workers (condition of employment) Act, 1966, (b) government/public sector enterprises and (c) cooperatives. However the coverage was expanded to cover non-household unorganized enterprises which were earlier outside coverage irrespective of their scales due to the non-availability of a frame and background information. In addition, Self Help groups (SHGs), Private Non-Profit Institutions (NPIs) including Non-Profit Institutions Serving Households (NPISH) and Trusts are also considered in this Round.

The survey under the Annual Survey of Industries is conducted over a number of months treating a preceding period of one year as the reference. For example in ASI 2001-02 data collected from the establishments relate to their accounting year ended on any day between 1st April 2001 and 31 March 2002 (the terminal year) but the survey was conducted at a date between October 2002 and March 2003. The ASI publication came into public domain on July 2004.

In NSS data the reference period for recording details of various items depended primarily on whether the enterprise under survey (i) would provide information from their books of account, (ii) or they could provide information orally. In the case (ii) information by recollection is collected in three kinds of reference periods reference month, reference year and last date of the reference month. Data of receipts, expenses and value added are provided orally for reference month. For enterprises working (perennial) continuously for 30 days or more including scheduled holidays in the current season the reference month is the last 30 days preceding the date of survey and for casual enterprises that worked less than 30 days in the current season the reference month is the average month in the last working season. In the case of enterprises with a book of account the reference year is the last completed accounting year of the enterprise. For example the survey for NSSO 2005-06 report published in February 2008 was conducted during July 2005 to June 2006.

A4.3: Activities included in Food Processing

Table A4.3.1: Activities included in Agro-processing: PRIMARY (5 digit NIC 2004 in brackets)	
Activity Group	**Activities**
Production, Processing and Preservation of Meat and Meat Products	Mutton slaughtering (15111), Beef slaughtering (15112), Pork slaughtering (15113), Poultry and other slaughtering (15114), preservation of meat except by canning (15115), rendering and refining of lard and other edible animal fats (15117), production of flours and meals and meat and meat offals (15118)
Production, Processing and Preservation of Fish and fish Products	Sun drying of Fish (15121)
Processing and Preservation of Fruits and Vegetables	Sun drying of fruits and vegetables (15131), fruit and vegetable preservation n.e.c (15139)
Manufacture of Vegetable and animal Oils and fats	Manufacture of hydrogenated oil and vanaspati ghee (15141), manufacture of vegetable oils and fats (excluding corn oil) (15142), manufacture of vegetable oils and fats through solvent extraction process (15143), manufacture of animal oils and fats (15144), manufacture of fish oil (15145), manufacture of non-defatted flour or meals of oilseeds, oilnuts or kernels (15147).
Manufacture of Dairy Products	Manufacture of Pasteurized milk whether or not in bottles/ polyethene packs, etc. (plain or favoured) (15204)
Manufacture of Grain mill products	Flour milling (15311), rice milling (15312), dal milling (15313), processing and grinding of grain (15314), vegetable milling, flour or meal of dried leguminous vegetables (except dal), of roots or tubers, or of edible nuts (15315), other grain milling and processing activities (15319)
Manufacture of Starches and Starch Products	Manufacture of starch (15321), manufacture of sago and sago products (15322), Manf. of glucose and glucose syrup, maltose (15323), manf. Of gluten (15324), manf. of tapioca substitutes prepared from starch (15325), manufacture of corn oil (15326), manfg of other starch products (15329) .
Manufacture of Prepared Animal Feed	Manufacture of cattle feed (15331), Manufacture of poultry feed (15332), Manufacture of other animal and bird feed (15339)
Manufacture of Sugar	Manufacture and refining of sugar (15421), Manufacture of Gur from sugarcane and other sources (15422, 15423), manf. of khandsari from sugarcane and other sources (15424, 15425), manf. of boora from sugarcane and other sources (15426, 15427), manf. of molasses (15428), manf. of other indigenous sugarcane/ sugar beet/ palm juice products (15429).
Manufacture of Spices	Grinding and processing of spices (15495)
Manufacture of Beverages	Manf. of country liquor (15511)

Table A4.3.2: Activities included in Agro-processing: VALUE ADDED (5 digit NIC 2004 in braces)	
Activity Group	**Activities**
Production, Processing and Preservation of Meat and Meat Products	Processing and canning of meat (15116); Production, processing and preserving of other meat, meat products, n.e.c. (15119)
Production, Processing and Preservation of Fish and fish Products	Artificial dehydration of fish and sea food (15122); Radiation preservation of fish and similar food (15123); Processing and canning of fish (15124); Manufacturing of fish meal (15125); Processing and canning of frog legs (15126); Processing and preserving of fish crustacean and similar foods (15127); Processing & preserving of other fish and fish products, n.e.c. (15129)
Processing and Preservation of Fruits and Vegetables	Artificial dehydration of fruit and vegetables (15132); Radiation preservation of fruit and vegetables (15133); Manufacturing of fruit/vegetable juices and their concentrates (15134), squashes and powder; Manufacture of sauces, jams, jellies and marmalades (15135); Manufacture of pickles, chutneys, murabbas etc. (15136); Canning of fruit and vegetables (15137); Manufacture of potato flour & meals and prepared meals of vegetables (15138); Fruit and vegetables preservation n.e.c. (including preservation by freezing and roasting of nuts.) (15139)
Manufacture of Vegetable and animal Oils and fats	Manufacture of cakes & meals incl. residual products, e.g. Oleostearin, Palmstearin (15146)
Manufacture of Dairy Products	Manufacture of milk powder, ice-cream powder and condensed milk except baby milk foods (15201); Manufacture of baby milk foods (15202); Manufacture of butter, cream, ghee, cheese and khoya etc. (15203); Manufacture of ice-cream and kulfi etc. (15205); Manufacture of other dairy products, n.e.c. (15209)
Manufacture of Grain mill products	Manufacture of breakfast foods obtained by roasting or swelling cereal grains (15316); Manufacture of prepared, blended flour, wet flour for food preparation and dough for bread, cake, etc. (15317); Manufacture of other readymade mixed powders like idli, gulabjamun etc. (15318); Other grain milling and processing activities like manufacturing of poha/ muri etc, n.e.c. (15319)
Manufacture of bakery products	Bread making (15411); Manufacture of biscuits, cakes and pastries (15412); Manufacture of other bakery products n.e.c. (15419)
Manufacture of cocoa, chocolate and sugar confectionery	Manufacture of cocoa products (15431); Manufacture of sugar confectionery (except sweetmeats) (15432); Manufacture of sweetmeats (15433); Manufacture of chewing gum (15434); Preserving in sugar of fruits, nuts, fruit peals and other parts of plants (15435); Other activities relating to manufacture of cocoa, chocolate and sugar confectionery n.e.c. (15439)

Table A4.3.2: Activities included in Agro-processing: VALUE ADDED (5 digit NIC 2004 in braces) (continued)	
Activity Group	**Activities**
Manufacture of macaroni, noodles, couscous and similar farinaceous products	Manufacture of macaroni, noodles, couscous and similar farinaceous products (15440)
Manufacture of other food products n.e.c.	Processing and blending of tea including manufacture of instant tea (15491); Coffee curing, roasting, grinding and blending etc. including manufacture of instant coffee, chicory and other coffee substitutes, essence of concentrates of coffee (15492); Processing of edible nuts (15493); Manufacture of malted foods including food for infants and invalids (15494); Manufacture of papads appalam and similar food products (15496); Manufacture of vitaminised high protein flour, frying of dals & other cereals (15497); Other semi-processed, processed or instant foods n.e.c. except farinaceous products and malted foods and manufacturing activities like manufacture of egg powder, sambar powder etc. (15499)
Manufacture of beverages	Distilling, rectifying and blending of spirits, ethyl alcohol production from fermented materials n.e.c. (other than soft drinks, mineral water & wine) (15519); Manufacture of wines (15520); Manufacture of beer (15531); Manufacture of malt liquors other than beer (15532); Manufacture of malt (15533); Manufacture of malt liquors and malt n.e.c. (15539); Manufacture of aerated drinks (15541); Manufacture of synthetic flavored concentrates and syrups (15542); Manufacture of soft drinks (15545); Manufacture of other non-alcoholic beverages n.e.c. (15549)
Manufacture of tobacco products	Manufacture of cigarette and cigarette tobacco (16003); Manufacture of cigars and cheroots (16004); Manufacture of pan masala and related products. (16008)
Manufacture of Chemicals and Chemical Products	Manufacture of basic chemicals (241); Manufacture of other chemical products (242); Manufacture of man-made fibers (243).
Production, collection and distribution of electricity	Generation and distribution of bio-gas energy (40107); Generation of electricity from other non-conventional sources. (40108)

Table A4.3.3: Activities included under Basic Processing		
Commodity	**NIC (2004)**	**Description**
Paddy	15312	Rice milling
Wheat, raw	15311	Flour milling
Sugarcane	15421	Manufacture and refining of sugar (vacuum pan sugar factories)
	15422	Manufacture of `gur'from sugar cane
	15424	Manufacture of `khandsari' sugar from sugar cane
	15426	Manufacture of `boora' and candy from sugar cane
	15428	Manufacture of molasses
Oilseeds	15141	Manufacture of hydrogenated oils and vanaspati ghee etc.
	15142	Manufacture of vegetable oils and fats (excluding corn oil)
	15143	Manufacture of vegetable oils and fats through solvent extraction process

A4.4. Conversions, Methodology and other specifications

The official sources from which the unit level data used is acquired is broadly the two sets government agencies (i) CSO and the NSSO operating under Ministry of Statistics and Programme Implementation for agriculture for data on inputs used in industry and (ii) the Department of Economics and Statistics, National Horticulture Board, Department of Animal Husbandry and similar other data collecting and reporting agencies under the Ministry of Agriculture, Government of India. In the subsequent explanatory notes the Ministry of Agriculture is denoted by 'Ministry' for brevity and explanation revolves more around data taken by us from this source. Ministry sources are (MOA_d, various, MOA_b, various). Price data from Ministry is as reported in Agricultural Prices in India. The production is corrected for wastage and other allowances like seed and feed to get net supply. The wastage data is as estimated in a study sponsored by MOFPI (CIPHET, 2010). Seed and feed allowances are as suggested by Ministry sources.

The data as available in official sources do not generally suffice in that form to make the estimates of the extent of food processing. Moreover the data as required is not always reported by the Ministry. In

the latter case other possible sources are also explored as a last resort (such as FAO in FAOSTAT, website) and even if that attempt is futile, assumptions and projections need to be made. The data is not necessarily reported in the same unit. In all cases we have converted the quantities to weights (million tonnes) if necessary by using average weights. In some cases further transformations are required such as into edible parts, component parts (such as shell, kernel, husk, oil). Largely the objective is to make the quantity data compatible with the input data derived from ASI and NSSO especially simultaneous and multiple uses are possible of a product (usage of grain as food does not mean wastage of the husk)..

Prices are taken as averages of market level prices reported by the Ministry covering all reported markets and expressed as Rs/Kg. In the absence of data on certain items or their components assumptions were required. In a few cases the estimation of price of a semi-processed input is made using the ratio of its price to the raw products as obtained from ASI data 2004-05 (which is reliable). The approximations are validated by matching in the sources of prices such AGMARKNET and other websites. In general the data set was created with much care and consultation and it is admitted that while alternate sources were recourse in limited cases, intuition, empirical reviews and reasonable judgement were inevitably required in the entire exercise.

1) Meat:

Meat (slaughtered- fresh or frozen) includes: Chicken (including dressed) , Other poultry birds, Bacon, Buffalo meat, Beef, Veal, Mutton and Other Meat

The selected products for calculation of price are Buffalo meat, Cow meat or beef including veal, Goat meat or Mutton including Sheep meat, Chicken meat including duck and Pork or bacon.

In the case of production the Ministry reports the production of meat without much detail except the mention that poultry meat was not part of this estimate prior to 2007. Estimate of poultry meat is reported in the government publication Poultry in 21st century (Mehta, Nambair, 2008). Production of chicken, mutton, pig, buffalo and cow meat separately could be obtained from FAOSTAT (calculated by FAOSTAT, website). This data differs from the meat production reported by the Ministry in the reference year, which appears not inclusive of all the components mentioned above. Thus for

production data is reliance is placed on FAOSTAT after a reasonable reconciliation with information available from other sources (Table A 4.3.2).

However, Industry data (ASI and NSSO) also includes purchase of live animals procured that may possibly be transformed to meat internally. Assuming that the production data we use is for meat only and excludes procurement of live animals by agencies for different purposes, the total meat offered is assumed to be the sum of the meat production in raw, dressed or frozen form. To the extent the Ministry's or FAO's data on meat also takes account of live animal slaughtered in-house our estimate of production offered will be an overestimate.

Price of buffalo meat and veal meat are assumed to be same as that of beef, sheep meat same as mutton, duck meat same as chicken and bacon same as pork (Table A 4.3.2).

2) Animals Live:

Animals are consumed by industries directly as live animals or as meat. ASI and NSSO therefore report both forms separately and there are issues perplexing of aggregation, interpretation and data availability. It may be reasonably presumed that live animals are slaughtered in-house for further processing and may be carried over with nurturing if they are not used in the current fiscal year.
Live animal includes: Buffalo, Cow, Goat, Pig, Sheep, Chicken, Duck, animals live n.e.c and poultry birds n.e.c.
Of theses, the selected live animals (for calculation of price) do not include only animal's live n.e.c and poultry bird's n.e.c
Live animals as inputs purchased are reported in numbers. To arrive at the total quantity in weights, the numbers of each animal are multiplied by the average weight to express them as kg. Since the entire weight is not available for processing or consumption, adjustment is made for the inedible portion to obtain the net meat equivalent. An example to this is conversion is presented for Buffaloes live.

Say, Buff meat $_{live}$=buff number * weight $_{b}$ * (1-W_{INED})
Where,
Buff meat $_{live}$ =estimated weight of meat or meat equivalent obtained from the number of live buffalos.
buff number: =number of buffalos reported as material consumed

weight $_b$ =average weight of an Indian buffalo

W_{INED} =proportion of inedible part

The average weight of animal and the inedible part corrected to 'hot carcass' and $W_{INED,}$ compiled from a review of information (there is wide variation across regions, breeds and practices) available are presented in the Table A4.3.1 along with wastage ratios. These figures are used in the analysis.

Table A4.4.1: Allowances and conversions for Animals and meats

Animal	Post Harvest losses (CIPHET)	Average Weight * (kg)	Not edible portion * (%)
Chicken	3.7	3.8	30.0
Goat	2.3	41.3	40.0
Sheep	2.3	27.1	40.0
Duck	3.7	4.0	30.0
Cow	2.3	363.0	40.0
Buffalo	2.3	500.0	40.0
Pig	2.3	162.5	25.0

* Estimated average based on empirical miscellaneous literature.

In the case of ASI data from organized industry, the derived quantity is calculated from value and price data. It is presumed that processors buy live animals cheaper than meat available in market and incur the cost of feeding, maintenance and slaughtering. We assume the price of meat equivalent of live animal to be 80% of market price of fresh meat based on empirical literature, articles and discussions. Procurement of animals from market is then corrected for inedible parts and wastage (40% of the wastage in case of meats). Price of beef, pork, chicken and mutton are obtained from Ministry publication. 'Production' of live animals in conceptualized as the quantity offered which again is presumed to be the quantity purchased for processing. Thus the extent of agro-processing (all) of live animals is tautologically equivalent to one.

Table A 4.4.2: Information on Meat production

Meat	Source of data	Production in 04-05 (Million tonnes)
Buffalo meat	FAO	1.335
Cattle meat	FAO	0.964
Chicken meat	FAO	1.304
Duck meat	FAO	0.039
Goat meat	FAO	0.487
Meat nes	FAO	0.155
Pig meat	FAO	0.445
Sheep meat	FAO	0.238
Poultry Meat	FAO	1.343
Total Meat*	FAO	4.967
Total Meat	DoAH	2.200
Poultry Meat**	MOA	0.507

Note: *Total meat reported by FAO constitutes the total of meats of Buffalo, cattle, chicken, duck, meat n.e.s, pig and sheep. ** Poultry meat estimate is the MOA reported figure taken from Mehta and Nambiar, 2008.

3) Fish:

Fish and seafood are both included in this coverage.

Inland fish includes: Pomfret, Cattle, Sardine, Ribbon fish, Hilsa, Other (non-frozen) fish

Marine fish includes: Lobster, Prawn, Shrimps, Sea-shell, Frozen fish, Crustaceans, Others

The selected Inland fish and Marine fish are all the fish and sea animals stated above.

Prices of few different river fish are reported by Ministry. The average price obtained from this source is assumed to be the price of inland fish covering. Since the price of marine fish for the reference year could not be found and since they are likely to be costlier than the inland fish and more amenable to export the price of marine fish is assumed to be higher at 1.5 times that of inland fish. Total fish production disaggregated as inland and marine is obtained from Ministry source (GOI_a, various, MOA_a, various). Correction for wastage is made. Since production data for fish comes in only two composite groups, inland fish and marine fish, separate estimates for the constituent components cannot be given.

4) Milk, Fresh:

Milk quantities processed are declared in either k. Litres or tonnes by factories although the units cannot be used reliably in ASI data. Only fresh milk is considered and no primary and secondary processed milk is included in the calculation although arguably farmers may be producing some amount of products like ghee, butter and curd. Fresh milk production is obtained from Ministry data and corrected for wastage. Price of milk is also taken from Ministry source. The 2010-11 data informs that fresh milk is constituted of cattle and buffalo milk only (but here in this study we have incorporated milk n.e.c in the fresh milk estimate) is compatible with previous data although data on milk of sheep, goat, camel and n.e.c are also reported in 2010-11.

Table A4.4.3: Allowance for Livestock products

Commodity	Losses estimated (%)	Seed (%)	Feed (%)
Egg	6.60	0.00	0.00
Inland fish	6.90	0.00	0.00
marine fish	2.90	0.00	0.00
meat	2.30	0.00	0.00
Poultry meat	3.70	0.00	0.00
Milk	0.80	0.00	0.00

Source: CIPHET, 2010; seed, feed assumed.

5) Eggs, All types:

Quantities of eggs consumed as inputs are usually given in numbers A conversion rate of 1 egg= 50 grams is employed to obtain a weight corresponding to eggs. Production of eggs is similarly expressed in million tonnes and is corrected for wastage. Eggs include hen eggs, eggs from other birds, preserved egg yolk, albumin, etc. and eggs without shell. Egg data constitutes of the total of all the above mentioned variants of egg. Price of egg is also readily available.

6) Fruits:

Fruits consumed as inputs include: Pomegranate, Lemon, Grapes, Mango, Mango pulp (including dried pulp), Papaya, Fresh Orange, Other fresh fruits.

Select fruits for calculation of price exclude pomegranate, lemon and other fresh fruits. Select fruit Mango also includes mango pulp. Wholesale prices of select fruits except orange are not reported in the Ministry source and could be accessed from FAO. The price of mango pulp is assumed to be 20% more than fresh mango. Production data is taken from National Horticulture Database. The quantities reported are suitably converted to million tonnes. While wastage is corrected for, no allowance is made for seed as interactions with sources in the Ministry revealed that for horticultural crops it is a general practice to preserve plant materials rather than seeds for regeneration.

Table A4.4.4: Allowance for Fruit production

Crop/Commodity	Losses estimated (%)	Seed (%)	Feed (%)
Apple	12.30	0.00	0.00
Banana	6.60	0.00	0.00
Citrus	6.30	0.00	0.00
Grapes	8.30	0.00	0.00
Guava	18.00	0.00	0.00
Mango	12.70	0.00	0.00
Papaya	7.40	0.00	0.00
Sapota	5.80	0.00	0.00

Source: CIPHET, 2010; Assumed that seed, feed allowance is zero and plant Regeneration method does not involve seeds.

7) Vegetables:

The Vegetables that are considered in this study include: Beans, Beets, Green Matar, Fresh Mushroom, Dried or Frozen Mushroom, Green pea, Squashes, Tamarind, Tamarind seed, Other fresh vegetables, Other preserved vegetables (Frozen or not), Myrobalan[1], Other edible vegetables, Potato, Onion, Onion flakes, Tapioca, Tapioca chips, Tapioca waste, Tapioca root, fresh Tomato, green Chilli.

Selected Vegetables for calculation of price include: Potato, Onion, Onion flakes, Tapioca, Tapioca chips, Tapioca waste, Tapioca root, fresh Tomato and green Chilli.

[1] Grown in Asian countries myrobalan (haritaki) grown as deciduous trees and is used as digestive, anti-inflammatory and medicinal material.

Wholesale prices of select vegetables are obtained from Ministry data and NHB. Tapioca is used in raw form and other basic processed forms. The prices are assumed to be as follows: tapioca chip price is 10% more than tapioca, and other components like waste and root are 80% of tapioca price. Production is reported by Ministry and is corrected for wastage. The processed quantity of tapioca is assumed to be additive and Tapioca processing is the sum of all the components. Similarly onion as whole vegetable and as flakes, both reported as inputs, are assumed to be additive. The sum of input of both components as a ratio of total onion production net of wastage is considered for Onion processing. While wastage is corrected for, no allowance is made for seed for reasons as in Fruit.

Table A4.4.5: Allowance for vegetable production

Crop/Commodity	Losses estimated (%)	Seed (%)	Feed (%)
Cabbage	6.90	3.00	0.00
Cauliflower	6.80	3.00	0.00
Green pea	10.30	3.00	0.00
Mushroom	12.50	3.00	0.00
Onion	7.50	3.00	0.00
Potato	9.00	3.00	0.00
Tomato	12.40	3.00	0.00
Tapioca	9.80	3.00	0.00

Source: CIPHET, 2010; seed, feed allowance is assumed.

8) Spices:

Spices include: Raw Chickory, root Chickory, Chickory powder, Cherry robusta powder with chickory, Cherry robusta powder, Coffee, cherry and other preparations, Ajawain, Saunf, Asafoetida (Hing)[2], Spices mixed, While sesame (til), Cinamon (Dalchini), Ginger (Adrak), Garlic (Lahsun), Gralic flakes, dry Chilli, Cumin seed (jeera), Coriander seed (Dhaniya), Illaichi (Cardamom), Pepper (Kalimirch), Turmeric (haldi) Other spices.

[2] Ajwain also known as Bishop's weed is a seed like fruit found in Asian countries used for flavour in many dishes and as meal refreshment. Cherry powder is made from pure freeze dried cherries and used to flabour and colour drinks, desserts and sauces. Chicory also known as blue daisy is an additive to coffee. Saunf, also known as fennel, is an aromatic plant with edible seeds,

The select spices for calculation of price are Ginger, Garlic (including flakes), Coriander seed, Cumin seed, Turmeric, Pepper and dry Chilly for which production and wholesale prices (marked as red or dry) are available. Only coriander seed price was assumed to be same as Cumin seed price. Production data for all the select crops is available in Ministry source. Dry chilli production is not segregated from green chilli. Both wastage and seed allowance of 3% are corrected for to arrive at net supply.

9) Cashew nut

Cashew nut includes Cashew kernel, Cashew nut in shell, Cashew nut shell liquid, Cashew nut shell, Cashew nut shell husk.

Prices of Cashew nut in shell and Cashew kernel are both reported by Ministry. Assumptions made are that the price of Cashew nut shell and Shell liquid are half the price of Cashew nut in shell and price of Cashew nut shell husk is assumed half of that of the shell. The estimate is made only for 2005-06

Production of Cashew nut is only reported by Ministry without further detail. Cashew nut kernel and shell are apportioned using conversions provided by ministry (25:75) and Shell husk and Shell liquid are assumed to be 75% and 90% respectively of the shell. Wastage and seed allowance of 30% are corrected for. The extents of the different components are added up.

Table A4.4.6: Allowance for Spices and nut production

Crop/Commodity	Losses estimated (%)	Seed (%)	Feed (%)
Arecanut	7.90	3.00	0.00
Black pepper	3.90	3.00	0.00
Cashew	1.10	3.00	0.00
Chilli	5.60	3.00	0.00
Coconut	5.40	3.00	0.00
Coriander	7.30	3.00	0.00
Sugarcane	8.70	0.00	0.00
Turmeric	7.40	3.00	0.00

Source: CIPHET, 2010; seed, feed allowance is assumed.

10) Groundnut

Groundnut is used in the oil making sector but it is also consumed and processed as a nut. The input data is presented as Shelled, Unshelled and kernel. Conversions are used from Ministry source treating kernel and unshelled nut as equivalent. Ministry presents production of nut in shell as well as a conversion ratio from nut to kernel. The production (nut in shell) is corrected for wastage and 3% seed allowance. Price of groundnut as nut in shell is reported by Ministry but to arrive at the price of kernel and unshelled we project the price based on the price ratio got from AGMARNET report ($GOI_{b,}$, website) of the two components in the recent period. The ratio is about 2.14. The components unshelled and kernel is added up.

11) Rice Milled:

The rice types that are studied for processing are: par boiled, basmati, broken and raw (excluding basmati), basmati and powder rice.

Rice production is taken from Agricultural Statistics at a glance while the prices are taken from Agricultural Prices in India against Par boiled and raw rice. Further, it is assumed that powder rice is 20% more than raw rice in terms of WSP due to the more intense primary processing, while broken rice's price is 80% of that of raw rice. Basmati rice is assumed to have a WSP double of that of powder rice.

12) Wheat:

Raw wheat is taken to constitute of wheat java both in unmilled and milled, wheat raw and wheat (excluding wheat seed), which is primarily processed to get atta, maida and wheat broken. Each of the raw wheat and primary processed groups are summed up for their quantities and values and compared to the production of wheat of that particular financial year. The WSPs of atta, maida and broken wheat are computed by multiplying the WSP of raw wheat by a multiplier derived on the basis of ratios of the respective types of wheat's imputed prices (=value/ quantity) from ASI 2004-05.

Table A4.4.7: Allowance for Cereal production

Crop/Commodity	Losses estimated (%)	Seed (%)	Feed (%)
Paddy	5.20	3.00	6.00
Wheat	6.00	3.00	6.00
Maize	4.10	3.00	6.00
Bajra	4.80	3.00	6.00
Sorghum	3.90	3.00	6.00

Source: CIPHET, 2010; seed, feed allowance is assumed based on expert advice.

13) Coarse cereals Milled:

Coarse cereals milled include: Barley, Jowar, Bajra, Maize including maize, Maize fried, Maize flour, Corn flour, Maize starch.

Selected items are Jowar, Bajra, Maize and the different Maize components for price calculation. For the maize components maize fried is assumed to be priced 10% higher than that of maize, while maize flour and corn flour are assumed to be priced 20% higher than of maize and 40% higher in maize starch.

14) Pulses Milled:

Milled pulses (dal) include: Milled matar, Peas dal, milled Rajma, broken Pulses (churi, chaurni), milled Arhar (tur), milled black gram (biuli), milled Masur (Lentil), milled Moong (green gram), Gram dal, Gram flakes other milled Pulses,.

Selected milled pulses for calculation include Bengal gram (excluding seed), Black gram (urad), red Gram (Arhar or Tur), green gram (Moong), Masur (Lentil). Selected milled pulses are Arhar, Masur, Moong and Gram (dal and flakes).

Prices available are for whole and split Gram, and for whole Masur, Moong, Arhar, Urad. The price of flakes is assumed to be the same as that of split Gram. The WSPs of milled arhar, milled moong are computed by multiplying the WSP of unmilled arhar and unmilled moong respectively by a multiplier derived on the basis of ratios of the respective types of pulses' (unmilled to milled) imputed prices

(=value/ quantity) from ASI 2004-05. Masur milled is assumed to have the same WSP as that of its unmilled counterpart. The conversion factor for unmilled to milled pules range from 1.16 to 1.20.

For the analysis all Gram versions are added up as similar and exclusive.
Production data of each of pulse variety is available. Correction is made for wastage and seed allowance (3%).

Table A4.4.8: Post-harvest losses in Pulses (CIPHET)

Crop/Commodity	Losses estimated (%)	Seed (%)	Feed (%)
Pigeon pea	5.40	3.00	0.00
Chick pea	4.30	3.00	0.00
Black gram	6.10	3.00	0.00
Green gram	5.50	3.00	0.00

Source: CIPHET, 2010; seed, feed allowance is assumed.

15) Oils and allied inputs:

The oil group is seen as different sub-categories as the products can be used for various purposes. The coverage of the sub-categories and the selected items are as follows:

Oilseeds: mowrah, sesame (til/gingelly), groundnut, soyabean and sunflower, oil-seed/seed, n.e.c.
Selected Oilseeds: groundnut, soyabean and sunflower oilseeds.

Oil: Maize, Sunflower, Soyabean, Groundnut, rapeseed, Mustard, other vegetable oils
Selected Oil: Groundnut, rapeseed, Mustard, Linseed

Oil Refined oil: Soyabean, Sunflower, Groundnut, Mustard, Rapeseed, Other refined oils
Selected Oil Refined oil: Groundnut, Mustard, Rapeseed

Oil cake: Sesame, Castor, Linseed, Mowrah, Sunflower, Maize, Mustard, Rape, Groundnut
Selected Oil cake: Sunflower, Maize, Mustard, Rapeseed, Groundnut

Prices are collected in respect Groundnut oilseed, Rapeseed oilseed, Mustard oilseed, Soyabean seed, Linseed, Sunflower oilseed for oil, Groundnut oil, Mustard and Rapeseed oil for oil, Oilcake sesame, Oilcake castor, Oilcake Linseed, Oilcake Mustard, Oilcake Rapeseed, and Oilcake Groundnut oilcakes. Refined oil price is assumed to be 3 times the oil price of the same variety. These items make up the selected items.

Production of Rapeseed Mustard, Soyabean, Groundnut, Linseed, Sunflower are collected from Ministry as also oil and refined oil production. Oilcake production is obtained by using conversions 67% cake to seed in the case of Maize and Oilseeds and the conversions 70% kernel to nut is shell and 60% oil to kernel in the case of Groundnut.

Production of sunflower oilseeds is taken from Agricultural Statistics at a glance (MoA).
Wholesale prices of oilseeds are taken with the assumptions that groundnut and soyabean oilseeds have the same WSP as that of groundnuts and soyabeans. Sunflower oilseeds are assumed to have the same WSP as that of soyabeans.

Table A4.4.9: Allowance for Oilseed production

Crop/Commodity	Losses estimated (%)	Seed (%)	Feed (%)
Mustard	8.90	3.00	6.00
Cottonseed	2.80	3.00	6.00
Soybean	6.20	3.00	0.00
Safflower	3.70	3.00	6.00
Sunflower	4.50	3.00	6.00
Groundnut	10.10	3.00	6.00

Source: CIPHET, 2010; allowance for seed, feed is assumed.

16) Unmilled Cereals :

Unmilled cereals consist of Paddy, wheat whole (wheat excl. seeds and wheat java) and Bajra unmilled.

Since rice is derived from paddy and involves a constant proportion of unusable wastage, for our study we stick to the constant = 2/3 i.e. 1 unit of paddy yields 2/3rd units of rice. Thus the production and wholesale price (WSP) which is given for rice is accordingly computed for paddy by -

Production of paddy= 3/2 * production of rice
WSP of paddy= 2/3 * WSP of rice

Wheat whole and unmilled Bajra are not given any separate treatment in terms of production and the production is taken to be the same as of their milled/ processed counterparts (conversion of 1:1). The prices taken from API are taken as those of the unmilled wheat and

17) Unmilled Pulses:

Unmilled pulses consist of matar unmilled, arhar unmilled, gram unmilled, masur unmilled and moong unmilled, pulse unmilled & products n.e.c
Selected unmilled pulses for the sake of calculating average price of these are arhar unmilled (Tur), gram unmilled, masur unmilled (Lentil) and moong unmilled (green gram).
The production of these unmilled pulses is assumed to be the same as that of their milled counterparts and wholesale prices which are taken from API are assumed to be those of the unmilled pulses itself.

18) Seeds:

Seed processing is considered only for the year 2005-06 for both organised and unorganised sectors.
Seeds include: Paddy seeds, wheat seed, corn seed and Jowar seed for cereals.
For seeds of oilseeds-linseed, rapeseed, groundnut and mustard are taken. Of these the ones which are not taken into selected category of seeds of oilseeds are seeds of linseed.
Production assumptions of seeds is as follows-
Ratio of paddy seed production to rice production is 1.5:1
Ratio of wheat, Jowar, corn seed production to wheat, Jowar, maize production is 1:1
Ratio of Groundnut, mustard and rapeseed seed production to Groundnut, mustard and rapeseed production is 1:1
Wholesale prices of cereal seeds as well as that of seeds of oilseeds are taken from the API.

19) Sugarcane, sugar:

Sugarcane is presented as sugarcane, Bagasse, Sugar and Gur
Sugar includes: Raw sugar, refined sugar, Sugar candy

Sugarcane, Bagasse

The price of sugar is obtained from Ministry sources and sugar refined and sugar candy price assumed 10% more than raw sugar. Sugarcane price is not reported in wholesale market. We have consulted Farm Harvest prices, presentation from Sugar industries and other experts and assumed Sugarcane price was Rs 0.90 per Kg in 2005. Similarly based on industry reports and trash to cane conversion we assume that bagasse price was Rs 0.30 per Kg.

A 4.5: Communication on 2010-11 data availability: emails of significance (NSSO)

Product code in NSS 67th Round

4:38 PM (51 minutes ago)

from:	**samiran mallick** samiran_mlk@yahoo.co.in
reply-to:	samiran mallick <samiran_mlk@yahoo.co.in>
to:	"ea.fpi@nic.in" <ea.fpi@nic.in>, "nila@iegindia.org" <nila@iegindia.org>
Cc:	S N Singh <satyanarain.singh@gmail.com>
date:	Mon, Feb 3, 2014 at 4:38 PM
subject:	Product code in NSS 67th Round
signed-by:	yahoo.co.in

This is to confirm that in NSS 67th Round ASICC or any other product identification code was not used in recording the information on major input/raw material and major products/by-products in the filled-in Schedules. As a result such product codes will not be available in the unit level data of NSS 67th Round.

regards

S. Mallick

ADG (SDRD)

A 4.6.Communications on Definitional Aspect: email of significance (USDA-NASS-IPO)

RE: Hello (Fresh & Processing definitions)

from: **Hoffman, Sarah - NASS** <Sarah.Hoffman@nass.usda.gov>

to: Nilabja Ghosh <nila@iegindia.org>

date: Wed, Feb 6, 2013 at 12:39 AM

subject: RE: Hello (Fresh & Processing definitions)

Hello Nilabja,

Thank you for kind words about my presentation. I enjoyed the workshop and wish I had more time to talk with you after the presentations.

When we publish acreage and production data on fresh and processing, we generally define them as:
Fresh: if it is sold to the consumer in an unaltered state. Lettuce that is picked, shredded, and bagged in the field is considered fresh.
Processing: if it is sold to the consumer after it has been altered by heat, pressure, chemicals (like pickling), or freezing temperatures.

I hope this information will be useful to you. Please let me know if you have any questions.

Best wishes,
Sarah

Sarah Hoffman
USDA-NASS-IPO
202-690-3084

from:	**Hoffman, Sarah - NASS** <Sarah.Hoffman@nass.usda.gov>
to:	Nilabja Ghosh <nila@iegindia.org>
date:	Sat, Mar 9, 2013 at 3:55 AM
subject:	RE: Hello (Fresh & Processing definitions)
mailed-by:	nass.usda.gov

Hello Nilabja,

Unfortunately, our current Fruit & Nut Publication and our Vegetable Summary report do not include Fresh and Processing definitions. I did find two place that did have definitions:
From our 2011 Certified Organic Production Survey publication (Direct link: http://usda01.library.cornell.edu/usda/current/OrganicProduction/OrganicProduction-10-04-2012.pdf ;
Organic Production reports webpage: http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1859):

> ***Processed products.*** *This includes products that were altered by heat, pressure, and/or freezing temperatures.*

From our interviewer's Terms and Definitions (page 31 and page 56):
Direct link: http://www.nasda.org/File.aspx?id=2467 ; NASS/NASDA webpage (NASDA refers to our interviewers/enumerators): http://www.nasda.org/NASS.aspx
Fresh Market - Designating fresh produce as opposed to canned, dried, or preserved produce.
Processing Plant - Business and corresponding buildings designed to carry out the operations, such as pasteurizing milk, curing meats, canning and preserving fruits, etc., required to prepare agricultural products for sale and consumption.
Processor - One who processes or prepares agricultural products by cooking, curing, etc.

There are some gray areas in these definitions. Fresh/Processing distinctions are made based on how the farmer sells them, not on the final usage. For example, grapes could be sold by the farmer for fresh market, but some of those grapes could end up in juice or wine (processed). Some crops (asparagus, broccoli and cauliflower) can have dual usage (when a single crop in a single season is used for both fresh and processing) – in these cases, both their fresh and processing are reported under fresh market. These are usually only footnote notations in a publication (ex. Annual Vegetable publication page 8- http://usda01.library.cornell.edu/usda/current/VegeSumm/VegeSumm-01-29-013.pdf) .
I hope this helps.
Sarah Hoffman
USDA-NASS-IPO
202-690-3084

Appendix 5

Table A5.1A: Validating ASI data: Prices derived and obtained from alternative sources (Rs/Kg)

	2003-04		2005-06		2010-11	
Crops	**ASI Imputed Purchase price**	**Wholesale Price**	**ASI Imputed Purchase price**	**Wholesale Price**	**ASI Imputed Purchase price**	**Wholesale Price**
Rice	9.82	13.09	8.04	9.56	17.73	36.52
Wheat	8.13	14.34	0.10	15.89	0.58	27.53
Coarse Cereals						
Maize	5.84	6.06	1.41	6.31	9.44	11.14
Jowar	6.93	6.81	6.70	7.38	10.17	14.98
Bajra	12.37	6.38	6.24	6.25	7.99	11.72
Pulses						
Gram	10.41	19.64	1.8	20.55	14.30	28.2
Arhar	13.94	20.14	20.69	21.29	38.49	52.75
Moong	15.41	23.95	34.12	27.25	35.80	66.65
Masur	23.99	20.1	45.18	25.01	-	43.76
Urad	13.29	15.91	23.42	21.29	28.96	47.80
Oilseeds						
Groundnut	15.92	64.51	15.57	36.41	23.98	53.71
Soybean	13.72	12.38	11.61	11.70	21.83	22.50
Oil						
Oil, Groundnut	45.03	57.36	0.19	49.64	2.27	77.73
Oil, Mustard	42.92	50.25	0.52	44.97	47.18	56.78
Oil, Rapeseed	32.35	50.25	17.55	44.97	4.30	56.78
Oil, Linseed	43.68	41.21	15.69	42.67	-	59.53
Refined Oil	44.6	150.76	40.35	136.87	11.03	188.08
Fruits						
Grapes	11.38	17.12	15.82	19.58	0.29	25.84
Mango	6.15	18.06	7.46	20.66	16.8	27.26
Papaya	2.53	9.12	0.15	10.43	0.06	13.76
Orange	-	12.52	0.12	16.03	0.11	19.45

Note: ASI imputed price is ASI reported value divided by ASI reported quantity. Wholesale Price is as reported by Ministry of Agriculture. Computed form ASI unit level data and MOA data

Table A5.1A: Validating ASI data: Prices derived and obtained from alternative sources (Rs/Kg) Contd..

Crops	2003-04		2005-06		2010-11	
	ASI Imputed Purchase price	Wholesale Price	ASI Imputed Purchase price	Wholesale Price	ASI Imputed Purchase price	Wholesale Price
Vegetables						
Onion	4.24	6.28	3.77	6.83	8.65	12.87
Onion Flakes	48.93	6.28	36.66	6.83	-	12.87
Potato	5.30	3.42	7.45	5.20	10.28	5.89
Tapioca	2.76	3.75	2.75	3.30	17.84	8.98
Tapioca Chips	2.63	4.13	3.39	3.62	5.18	9.87
Root, Tapioca	2.34	3.00	2.55	2.64	-	7.18
Tapioca Waste	4.02	3.00	3.43	2.90	-	7.18
Tomato, Fresh	4.12	7.64	6.27	7.88	5.22	11.13
Chillies, Green	11.36	42.96	29.25	28.14	29.46	59.58
Spices						
Ginger	53.41	19.25	92.81	27.98	52.58	37.08
Garlic	6.19	15.15	6.59	16.41	58.35	62.61
Garlic Flakes	18.52	2.65	15.93	16.41	-	50.09
Illachi	172.91	376.22	0.15	285.13	695.57	922.56
Chilli, Dry	35.85	42.84	0.18	56.30	65.81	53.00
Seed, Dhanya, Whole Or Broken	28.15	29.84	0.05	75.56	1.05	121.32
Cuminseed Processed Or Not (Jeera)	84.14	76.19	5.51	75.56	143.64	121.32
Pepper	78.51	89.83	1.64	74.75	45.87	165.37
Turmeric	36.30	36.90	0.15	31.13	2.62	144.71
Fish						
Fish Inland	122.69	46.15	6.09	48.83	56.19	82.46
Fish Marine	145.36	69.22	5.92	73.25	256.67	123.69
Milk fresh	10.44	15.57	0.04	16.34	19.29	26.28
Sugar	7.11	14.52	0.16	19.06	0.33	34.49
Egg	23.05	29.93	0.22	31.37	0.01	20.92
Meat	28.35	56.95	0.04	58.03	60.80	70.83

Note: ASI imputed price is ASI reported value divided by ASI reported quantity. Wholesale Price is as reported by Ministry of Agriculture. Computed form ASI unit level data and MOA data

Table A5.1B: Validating NSS data: Prices derived and obtained from alternative sources (Rs/Kg)

	2005-06			2005-06	
Crops	**Wholesale Price**	**NSS Imputed Purchase price**	**Crops**	**Wholesale Price**	**NSS Imputed Purchase price**
Rice	9.81	9.42	***Vegetables***		
Wheat	8.03	8.7	Onion	6.83	10.58
Coarse Cereals			Onion Flakes	6.83	0
Maize	6.31	7.04	Potato	5.2	7.58
Jowar	7.38	8.05	Tapioca	3.3	5.87
Bajra	6.25	6.5	Tapioca Chips	3.62	0
Pulses			Root, Tapioca	2.64	4.5
Gram	20.55	21.62	Tapioca Waste	2.9	11.11
Arhar	21.29	15.7	Tomato, Fresh	7.88	5.33
Moong	27.25	29.23	Chillies, Green	28.14	17.14
Masur	25.01	24.55	***Spices***		
Urad	21.29	31.96	Ginger	27.98	51.05
Oil			Garlic	16.41	32.03
Groundnut	24.81	12.34	Garlic Flakes	16.41	0
Soybean	11.7	10.74	Illachi	285.13	436.45
Oil			Chilli, Dry	56.3	37.25
Oil, Groundnut	49.64	50.25	Seed, Dhanya, Whole Or Broken	75.56	24.13
Oil, Mustard	44.97	44.43	Cuminseed Processed Or Not (Jeera)	75.56	82.02
Oil, Rapeseed	44.97	42.36	Pepper	74.75	59.86
Oil, Linseed	42.67	42.65	Turmeric	31.13	33.96
Fruits			***Milk fresh***	16.34	12.11
Grapes	19.58	169.43	***Sugar***	18.43	18.31
Mango	20.66	12.54	***Egg***	31.37	1.05
Papaya	10.43	15	***Meat***	58.03	51.39
Orange	16.03	0			

Note: Wholesale Price is as reported by Ministry of Agriculture. Computed form NSS unit level data and MOA data

Table A5.2A: Validating ASI data: Percentage processed of agro-products in the organized sector using alternative methods.

	2003-04		2005-06		2010-11	
Crops	**ASI based**	**Derived**	**ASI based**	**Derived**	**ASI based**	**Derived**
Rice	**1.09**	**0.97**	**1.43**	**1.24**	**2.45**	**1.46**
Wheat	**3.16**	**1.80**	**253.69**	**1.55**	**126.48**	**2.25**
Maize	26.66	25.32	122.91	27.55	18.94	16.06
Maize seed fried (popcorn)	0.34	0.37	1.24	2.32	22.39	19.14
Corn flour	0.00	0.00	0.01	0.01	0.03	0.02
Maize atta/ maida/ sooji/ flour	0.10	0.10	0.12	0.18	1.12	1.38
Maize starch	0.40	2.02	1.29	1.47	1.82	2.74
Jowar	1.57	1.60	2.49	2.26	2.24	1.52
Bajra	0.01	0.02	0.77	0.77	5.21	3.55
Coarse Cereals	**13.69**	**14.05**	**61.46**	**15.99**	**26.37**	**23.08**
Gram	11.04	5.85	61.82	5.39	27.89	14.14
Arhar	0.62	0.43	0.93	0.91	4.58	3.34
Moong	1.90	1.22	2.84	3.56	15.70	8.43
Masur	0.05	0.05	0.01	0.01	0.00	0.00
Urad	9.81	8.19	2.34	2.57	20.61	12.49
Pulses	**6.82**	**4.16**	**49.30**	**5.89**	**19.85**	**10.48**
Groundnut	**16.57**	**4.48**	**9.03**	**4.43**	**10.33**	**4.61**
Soybean	**46.28**	**51.28**	**11.72**	**11.63**	**36.00**	**34.88**
Oil, Groundnut	10.43	8.19	1674.20	6.55	268.50	7.84
Oil, Mustard	7.49	6.39	456.10	5.27	22.58	18.77
Oil, Rapeseed	3.66	2.36	8.98	3.50	30.64	2.32
Oil, Linseed	10.73	11.37	1178.03	433.09	0.00	0.00
Oil	**10.83**	**8.57**	**950.40**	**13.25**	**85.16**	**10.15**
Refined Oil	**2.32**	**0.68**	**1.90**	**0.56**	**70.52**	**4.13**
Grapes	5.61	3.73	12.66	10.22	342.43	3.86
Mango	2.18	0.74	4.14	1.50	5.24	3.23
Papaya	0.92	0.25	152.98	2.13	34.89	0.14
Orange	0.00	0.00	10.90	0.08	70.96	0.40
Fruits	**1.87**	**0.77**	**17.00**	**1.73**	**31.28**	**2.40**

Note: Computed form ASI unit level data and MOA data. ASI based: Using ASI reported quantity. Derived: Using quantity derived with support of MOA Wholesale Price data

Table A5.2A: Validating ASI data: Percentage processed of agro-products in the organized sector using alternative methods (contd..)

	2003-04		2005-06		2010-11	
Crops	**ASI based**	**Derived**	**ASI based**	**Derived**	**ASI based**	**Derived**
Onion	4.70	3.17	5.27	2.90	1.37	0.92
Onion Flakes	0.03	0.22	0.07	0.38	0.00	0.00
Potato	0.11	0.17	1.62	2.32	1.10	1.93
Tapioca	6.71	4.94	12.50	10.45	0.65	1.28
Tapioca Chips	0.57	0.36	4.59	4.29	14.36	7.53
Root, Tapioca	17.57	13.72	3.78	3.66	0.00	0.00
Tapioca Waste	0.04	0.06	0.01	0.01	0.00	0.00
Tomato, Fresh	1.93	1.04	0.77	0.61	0.91	0.43
Chillies, Green	0.24	0.06	3.51	3.64	0.11	0.05
Vegetables	**3.87**	**2.91**	**3.90**	**3.66**	**2.69**	**2.25**
Ginger	1.26	3.50	0.67	2.21	3.72	5.27
Garlic	2.46	1.00	5.73	2.30	0.31	0.29
Garlic Flakes	0.07	0.47	0.04	0.04	0.00	0.00
Illachi	34.40	15.81	59346.59	30.39	11.85	8.94
Chilli, Dry	14.91	12.47	1582.03	4.95	12.31	15.28
Seed, Dhanya, Whole or Broken	22.92	21.62	7926.52	5.67	1107.84	9.63
Cuminseed Processed Or Not (Jeera)	3.08	3.40	32.41	2.37	4.32	5.11
Pepper	5.84	5.11	856.33	18.84	70.14	19.46
Turmeric	8.82	8.67	1724.59	8.22	885.08	16.03
Spices	**9.56**	**8.55**	**1820.67**	**5.23**	**297.42**	**10.27**
Fish Inland	3.48	9.26	98.48	12.28	6.99	4.77
Fish Marine	6.18	12.97	186.39	15.07	5.25	10.89
Fish	**4.77**	**11.00**	**138.19**	**13.54**	**6.29**	**7.24**
Milk fresh	**14.86**	**9.96**	**4750.85**	**10.93**	**7.39**	**5.29**
Egg	**2.37**	**1.83**	**237.69**	**1.68**	**7212.56**	**2.82**
Sugar	**0.75**	**0.37**	**840.83**	**0.74**	**4.67**	**0.04**
Meat	**3.27**	**2.04**	**7641.82**	**6.11**	**12.15**	**11.37**

Note: Computed form ASI unit level data and MOA data. ASI based:: Using ASI reported quantity. Derived: Using quantity derived with support of MOA Wholesale Price data

Table A5.2B: **: Validating NSS data: Percentage processed of agro-products in the unorganized sector using alternative methods 2005-06**		
Groups	Extent of processing (%)	
	Derived	NSSO based
Milled Rice	0.36	0.26
Milled Wheat	0.50	0.58
Milled Coarse cereals	0.15	0.22
Milled Pulses	1.62	4.68
Groundnut	1.00	2.71
Soyabean	0.03	0.08
Edible Oils	0.18	0.64
Fruit	0.02	0.02
Vegetables	0.02	0.02
Spices	0.44	0.63
Fish	0.54	1.01
Fresh Milk	0.48	0.48
Eggs	2.99	0.17
Sugar	0.11	0.53
Meat	0.003	0.006
Source: NSS unit level data, MoA. NSSO based:: Using NSSO reported quantity. Derived: Using quantity derived using only imputed prices from a subset of processors who report quantity in Kg.		

Table A5.3: Estimated Extent of processing of select agro-products in all activities (%) in the Organized sector

Crops	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Milled Cereals								
Rice	**0.97**	**0.86**	**1.24**	**1.86**	**2.39**	**0.47**	**1.05**	**1.46**
Wheat	**1.80**	**1.21**	**1.55**	**1.94**	**3.55**	**1.54**	**3.40**	**2.25**
Maize	25.32	22.61	27.55	23.66	20.76	22.03	27.18	16.06
Maize seed fried (popcorn)	0.37	0.17	2.32	1.04	0.54	0.16	0.08	19.14
Corn flour	0.00	0.03	0.01	0.03	0.05	0.01	0.02	0.02
Maize atta/ maida/ sooji/ flour	0.10	0.05	0.18	0.29	1.18	0.49	0.86	1.38
Maize starch	2.02	3.86	1.47	1.62	1.81	1.42	1.76	2.74
Jowar	1.60	4.30	2.26	3.45	2.35	3.06	3.43	1.52
Bajra	0.02	0.41	0.77	0.28	0.40	0.83	0.58	3.55
Coarse Cereals	**14.05**	**12.70**	**15.99**	**14.14**	**12.64**	**13.31**	**17.29**	**23.08**
Milled Pulses								
Gram	5.85	2.29	5.39	2.12	3.01	2.63	8.61	14.14
Arhar	0.43	0.93	0.91	2.10	16.50	3.24	1.37	3.34
Moong	1.22	1.09	3.56	0.45	4.49	0.53	0.35	8.43
Masur	0.05	1.57	0.01	0.05	1.16	0.01	3.40	0.00
Urad	8.19	4.58	2.57	0.45	7.69	6.66	25.44	12.49
Pulses	**4.16**	**2.08**	**5.89**	**1.71**	**6.14**	**2.85**	**7.81**	**10.48**
Oilseeds, Nuts								
Groundnut	**4.48**	**3.18**	**4.43**	**4.59**	**6.07**	**6.15**	**3.04**	**4.61**
Soybean	**51.28**	**31.02**	**11.63**	**29.05**	**10.70**	**47.49**	**44.78**	**34.88**
Oil, Groundnut	8.19	12.18	6.55	20.99	116.65[¥]	14.05	6.89	7.84
Oil, Mustard	6.39	2.90	5.27	12.31	6.98	17.13	42.67	18.77
Oil, Rapeseed	2.36	1.22	3.50	3.86	10.12	12.52	8.05	2.32
Oil, Linseed	11.37	10.35	433.09[£]	8.10	10.17	1.11	3.90	0.00
Oil	**8.57**	**8.15**	**13.25**	**15.72**	**51.14**	**13.90**	**10.23**	**10.15**
Fruits								
Grapes	3.73	0.51	10.22	2.65	4.07	2.58	0.94	3.86
Mango	0.74	1.36	1.50	2.65	1.91	1.19	3.14	3.23
Papaya	0.25	0.84	2.13	0.15	0.65	2.78	0.05	0.14
Orange	0.00	0.03	0.08	0.00	0.04	20.82	0.60	0.40
Fruits	**0.77**	**1.10**	**1.73**	**1.32**	**1.81**	**3.06**	**2.12**	**2.40**

Sources: Computed from ASI, NSSO unit level data, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. [£] Estimates with respect to linseed oil appear large. The value reported by ASI for linseed oil is Rs 9000 million in 05-06,Rs 645 million in 04-05 and Rs 15 million in 06-07 in the NIC group 151. Estimates with respect to groundnut oil also appear large. The value reported by ASI for groundnut oil is Rs 19.3 billion in 06-07,Rs 90.8 billion in 07-08 and Rs 20.3 billion in 08-09 in the NIC group 151.

Table A5.3: Estimated Extent of processing all activities of select agro-products (%) in Organized sector (contd..)

Crops	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Vegetables								
Onion	3.17	1.94	2.90	2.81	1.24	1.52	0.77	0.92
Onion Flakes	0.22	0.003	0.38	0.003	0.00	0.11	0.05	0.00
Potato	0.17	0.44	2.32	0.79	1.24	1.03	0.83	1.93
Tapioca	4.94	11.05	10.45	2.88	7.22	5.99	5.17	1.28
Tapioca Chips	0.36	0.03	4.29	0.21	0.23	0.01	0.00	7.53
Root, Tapioca	13.72	4.94	3.66	4.99	0.62	0.31	8.65	0.00
Tapioca Waste	0.06	0.05	0.01	0.10	0.00	0.05	0.01	0.00
Tomato, Fresh	1.04	0.49	0.61	0.50	0.44	3.18	0.41	0.43
Chillies, Green	0.06	0.40	3.64	3.02	7.42	0.35	0.20	0.05
Vegetables	**2.91**	**2.52**	**3.66**	**2.13**	**2.25**	**1.88**	**2.54**	**2.25**
Spices all								
Ginger	3.50	2.24	2.21	2.95	3.55	1.88	3.96	5.27
Garlic	1.00	1.68	2.30	0.44	0.35	0.67	0.69	0.29
Garlic Flakes	0.47	0.08	0.04	0.0001	0.00	0.0001	0.03	0.00
Illachi	15.81	15.76	30.39	28.45	17.57	7.78	12.95	10.41
Chilli, Dry	12.47	10.49	4.95	14.27	12.83	12.53	15.61	15.28
Seed, Dhanya, whole or broken (Coriander)	21.62	10.36	5.67	50.57	27.69	29.41	23.46	9.63
Cuminseed Processed Or Not (Jeera)	3.40	1.16	2.37	33.96	5.29	8.00	9.43	5.11
Pepper	5.11	4.67	18.84	13.77	19.67	29.81	26.35	19.46
Turmeric	8.67	9.10	8.22	7.72	12.26	7.32	5.13	16.03
Spices	**8.55**	**6.93**	**5.23**	**12.66**	**10.14**	**9.02**	**9.29**	**10.27**
Fish all								
Fish Inland	9.26	5.02	12.28	6.19	11.57	10.62	16.36	4.77
Fish Marine	12.97	14.30	15.07	17.95	11.87	8.95	8.68	10.89
Fish	**11.00**	**9.25**	**13.54**	**11.19**	**11.64**	**9.92**	**12.79**	**7.24**
Animal								
Milk fresh	**9.96**	**9.45**	**10.93**	**13.58**	**13.21**	**11.89**	**12.48**	**5.29**
Egg	**1.83**	**1.97**	**1.68**	**3.72**	**1.34**	**1.88**	**1.95**	**2.82**
Meat	**2.04**	**2.37**	**6.11**	**5.66**	**10.21**	**7.48**	**5.79**	**11.37**
Sugar	**0.37**	**0.54**	**0.74**	**0.77**	**0.56**	**0.51**	**0.99**	**0.04**

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity

Table A5.4.1: Estimated extent of Processing of Agricultural products of different types: Animal based 2005-06

Items	Extent of Agro-processing %			Extent of only Value added processing %		
	Organized sector	Unorganized sector	Total economy	Organized sector	Unorganized sector	Total economy
			Animals live			
Buffalo	80.3	19.7	100	8.8	0.0	8.8
Cow	0.1	99.9	100	0.1	0.1	0.3
Goat	0.0	100.0	100	0.0	3.4	3.4
Pigs	9.7	90.3	100	1.7	0.9	2.6
Sheep	10.6	89.4	100	10.6	0.0	10.6
Chicken	38.2	61.8	100	12.0	0.0	12.0
Duck	99.9	0.1	100	0.0	0.0	0.0
Selected Live Animals	38.5	61.5	100	7.4	0.6	8.0
All Live Animals	**37.2**	**62.8**	**100**	**7.1**	**0.6**	**7.7**
			Animal Meat			
Bacon	0	0.0	0.00	0	0.0	0
Beaf	4.84	0.003	4.84	3.18	0.0	3.18
Buffalo Meat	13.48	0.0	13.48	11.22	0.0	11.22
Mutton	0.58	0.014	0.59	0.14	0.003	0.14
Veal Meat	2.32	0.0	2.32	2.29	0.0	2.29
Chicken, Dressed	0.5	0.0	0.50	0.16	0.0	0.16
Selected Meat	6.11	0.0	6.11	4.81	0.0	4.81
All Meat	**8.3**	**0.006**	**8.31**	**4.86**	**0.0**	**4.86**
			Fish			
Inland Fish	12.28	0.19	12.47	10.81	0.00	10.81
Marine Fish	15.07	0.95	16.02	14.9	0.52	15.42
All Fish	**13.54**	**0.54**	**14.08**	**12.66**	**0.24**	**12.90**
			Diary and Eggs			
Fresh Milk	10.93	0.5	11.41	4.14	0.4	4.55
Eggs (all types)	1.68	3.0	4.67	1.52	0.6	2.11

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. Agro processing include: basic, value added and other processing.

Table A5.4.2: Estimated extent of Processing of Agricultural products of different types: Horticultural crops 2005-06

Items	Extent of Agro-processing %			Extent of only Value added processing %		
	Organized sector	Unorganized sector	Total economy	Organized sector	Unorganized sector	Total economy
			Fruits			
Grapes	10.22	0.00	10.22	2.32	0.00	2.32
Mango	1.5	0.04	1.54	1.43	0.04	1.47
Papaya	2.13	0.00	2.13	2	0.00	2.00
Fresh orange	0.08	0.00	0.08	0.08	0.00	0.08
Select Fruit	1.73	0.02	1.75	1.24	0.02	1.26
All Fruit	**1.03**	**0.01**	**1.04**	**0.76**	**0.01**	**0.77**
			Vegetables			
Potato	2.32	0.04	2.36	2.32	0.03	2.35
Onion	3.29	0.01	3.30	3.26	0.00	3.26
Tapioca total	18.41	0.02	18.43	0.45	0.01	0.46
Fresh Tomato	0.61	0.01	0.62	0.6	0.01	0.61
Green Chilli	3.64	0.04	3.68	1.49	0.01	1.50
Select vegetables	3.66	0.02	3.68	1.62	0.02	1.64
All vegetable	**1.16**	**0.06**	**1.22**	**0.65**	**0.02**	**0.67**

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. Agro processing include: basic, value added and other processing.

Table A5.4.3: Estimated extent of Processing of Agricultural products of different types: Nuts and Spices 2005-06

Items	Extent of Agro-processing %			Extent of only Value added processing %		
	Organized sector	Unorganized sector	Total economy	Organized sector	Unorganized sector	Total economy
Cashewnut						
Cashew kernel	13.54	0.03	13.57	13.51	0.00	13.51
Cashewnut in shell	29.39	1.65	31.04	29.34	0.63	29.97
Cashewnut shell liquid	0.67	0.41	1.08	0.67	0.41	1.08
Cashewnut shell	4.53	1.08	5.61	2.43	0.05	2.48
Cashewnut shell husk	2.49	0.00	2.49	2.45	0.00	2.45
Groundnut and Soyabean						
Groudnut Shelled	3.35	0.91	4.26	0.88	0.36	1.24
Unshelled and Kernel	1.08	0.09	1.17	0.21	0.02	0.23
Soyabeans	11.63	0.03	11.66	0.41	0.00	0.41
Spices						
Ginger	2.22	0.03	2.25	0.74	0.00	0.74
Garlic	2.34	0.05	2.39	1.12	0.00	1.12
Dry Chilli	4.96	0.32	5.28	2.48	0.02	2.50
Cuminseed (jeera)	2.37	0.16	2.53	0.09	0.00	0.09
Coriander (Dhania Seed)	5.67	3.19	8.86	0.66	0.01	0.67
Cardamom (illachi)	30.39	0.17	30.56	4.81	0.03	4.84
Pepper (Kali mirch)	18.84	0.64	19.48	4.64	0.11	4.75
Turmeric (Haldi)	8.22	0.27	8.49	2.25	0.00	2.25
Select Spices	5.23	0.44	5.67	2.46	0.01	2.47
All Spices	**7.86**	**0.67**	**8.53**	**3.8**	**0.13**	**3.93**

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. Agro processing include: basic, value added and other processing.

Table A5.4.4: Estimated extent of Processing of Agricultural products of different types: Pulses 2005-06

Items	Extent of Agro-processing %			Extent of only Value added processing %		
	Organized sector	Unorganized sector	Total economy	Organized sector	Unorganized sector	Total economy
Gram, unmilled	11.67	4.38	16.05	0.26	0.03	0.29
Arhar, unmilled	37.63	11.80	49.43	0.47	0.00	0.47
Moong , unmilled	17.04	135.41	152.45	0.53	0.04	0.57
Masur, unmilled	35.8	2.13	37.93	0.19	0.00	0.19
Unmilled pulses selected	19.98	19.90	39.88	0.34	0.02	0.36
Unmilled pulses	**16.06**	**17.57**	**33.63**	**0.32**	**0.15**	**0.47**
			Milled Pulses			
Arhar	0.91	0.03	0.94	0.17	0.01	0.18
Black gram (urad or biuli)	2.57	0.23	2.80	0.3	0.01	0.31
Lentil (Masur)	0.01	1.98	1.99	0.01	0.00	0.01
Red gram (Moong)	3.56	0.08	3.64	0.24	0.02	0.26
Bengal Gram and components	5.41	1.61	7.02	0.51	0.02	0.53
Select Pulses	5.89	1.62	7.51	0.59	0.03	0.62
All Pulses	**4.17**	**1.27**	**5.44**	**0.37**	**0.14**	**0.51**

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. Agro processing include: basic, value added and other processing.

Table A5.4.5: Estimated extent of Processing of Agricultural products of different types: Cereals 2005-06

Items	Extent of Agro-processing %			Extent of only Value added processing %		
	Organized sector	Unorganized sector	Total economy	Organized sector	Unorganized sector	Total economy
Seeds						
Paddy seeds	1.11	0.41	1.52	0.11	0.01	0.12
Corn seed	2.74	0.00	2.74	2.07	0.00	2.07
Wheat seed	1.06	0.17	1.23	0.01	0.00	0.01
Jower seed	0.17	0.00	0.17	0	0.00	0.00
Cereal seed	**1.24**	**0.34**	**1.58**	**0.22**	**0.01**	**0.23**
Unmilled Cereals						
Wheat (excl. seed)	16.59	0.73	17.32	0.18	0.07	0.25
Paddy (excl. seed)	22.28	2.95	25.23	0.6	0.15	0.75
Wheat (java)	0.26	1.06	1.32	0	0.00	0.00
Bajra, unmilled	0.87	0.01	0.88	0.61	3.00	3.61
Unmilled cereals	**19.81**	**2.64**	**22.45**	**0.49**	**0.19**	**0.68**
Milled cereals						
Rice	1.24	0.36	1.60	0.34	0.07	0.41
Wheat	1.55	0.50	2.05	1.34	0.42	1.76
Jowar	2.27	0.03	2.30	1.03	0.00	1.03
Bajra	0.77	0.01	0.78	0	0.00	0.00
Maize	27.55	0.29	27.84	1.2	0.01	1.21
Select Coarse cereals	**15.99**	**0.15**	**16.14**	**1.34**	**0.01**	**1.35**
Coarse cereals total	**17.41**	**0.30**	**17.71**	**3.82**	**0.15**	**3.97**
Cereal Byproducts						
Wheat Gluten	0.0006	0.00	0.00	0	0.000	0.00
Rice bran	5.16	0.06	5.22	0.02	0.001	0.02
Wheat bran	0.04	0.00	0.04	0	0.000	0.00
Husk, animal feed	0.45	0.01	0.46	0.07	0.000	0.07
Husk other than Animal feed	0.17	0.02	0.19	0.01	0.000	0.01

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. Agro processing include: basic, value added and other processing.

Table A5.4.6: Estimated extent of Processing of Agricultural products of different types: Oil seeds, Oil and Oil products 2005-06

	Extent of Agro-processing %			Extent of only Value added processing %		
	Organized sector	Unorganized sector	Total economy	Organized sector	Unorganized sector	Total economy
			Oilseeds			
Oil-seed, groundnut	0.11	0.01	0.12	0.02	0.00	0.02
Oil-seed, soyabeans	46.85	0.00	46.85	0.37	0.00	0.37
Oil-seed, sunflower	12.46	0.03	12.49	0.13	0.00	0.13
Oilseeds for Oils	13.88	0.00	13.88	0.12	0.00	0.12
Oilseeds total	**16.95**	**0.13**	**17.08**	**0.5**	**0.00**	**0.50**
Seed, rapeseed	1.22	0.00	1.22	0	0.00	0.00
Seed, mustard	19.58	2.85	22.43	0.08	0.16	0.24
Seed, groundnut	1.07	0.19	1.26	0.59	0.00	0.59
Seed of oilseed	6.81	0.95	7.76	0.19	0.05	0.24
Seed of oilseed total	**6.76**	**0.95**	**7.71**	**0.25**	**0.05**	**0.30**
			Oilcakes			
Oil cake of Sunflower	1.27	0.01	1.28	0	0.00	0.00
Oil cake of Maize	22.45	0.00	22.45	0.16	0.00	0.16
Oil-cake of Mustard	6.15	0.35	6.50	0	0.00	0.00
Oil-cake of Rapeseed	7.83	0.00	7.83	0	0.00	0.00
Oil-cake of Groundnut	18.71	0.03	18.74	0.18	0.00	0.18
Select Oil cakes	14.67	0.08	14.75	0.09	0.00	0.09
Oil Cakes Total	**14.98**	**0.18**	**15.16**	**0.14**	**0.00**	**0.14**
			Edible Oils			
Oil, groundnut	6.55	0.31	6.86	1.16	0.25	1.41
Oil, rapeseed	3.5	0.00	3.50	1.93	0.00	1.93
Oil, mustard	5.27	0.11	5.38	0.44	0.03	0.47
Oil linseed	433.09	0.00	433.09	5.04	0.00	5.04
Select edible Oils	13.25	0.18	13.43	1.92	0.12	2.04
Edible Oils Total	**17.29**	**0.45**	**17.74**	**2.64**	**0.29**	**2.93**
Select refined Oils	0.56	0	0.56	0.46	0	0.46
Refined Oils Total	**3.84**	**0**	**3.84**	**1.92**	**0**	**1.92**

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. Agro processing include: basic, value added and other processing.

Table A5.4.7: Estimated extent of Processing of Agricultural products of different types: Sugar cane and Sugar 2005-06

	Extent of Agro-processing %			Extent of only Value added processing %		
	Organized sector	Unorganized sector	Total economy	Organized sector	Unorganized sector	Total economy
Sugarcane						
Sugarcane	91.02	2.46	93.48	0.25	0.03	0.28
bagasse	4.88	0.00	4.88	3.78	0.00	3.78
Sugar and Cane Products						
Raw sugar	0.5	0.28	0.78	0.22	0.06	0.28
Refined sugar	0.22	0.25	0.47	0.17	0.24	0.42
Sugar candy	0.02	0.00	0.02	0.02	0.00	0.02
Sugar	**0.74**	**0.53**	**1.27**	**0.40**	**0.31**	**0.71**
Jaggery	0.005	0.00	0.005	0.001	0.00	0.001
Badha (cane gur)	0	0.00	0.00	0.00	0.00	0.00
Cane gur (liquid)	0.001	0.00	0.001	0.00	0.00	0.00
Gur & sugar, n.e.c	0	0.003	0.003	0.00	0.001	0.001
cane juice, bottled/packed	0	0.00	0.00	0.00	0.00	0.00
cane juice, unbottled	0	0.00	0.00	0.00	0.00	0.00
Juice total	**0.006**	**0.004**	**0.010**	**0.002**	**0.001**	**0.003**

Sources: Computed from unit level data of ASI and NSSO, MOA data. Estimates may exceed unity if processing is more than currently produced/purchased quantity. Agro processing include: basic, value added and other processing.

Table A 5.5 : Extent of processing (%) in 2010-11 in the unorganized sector and the total economy: Projection based on alternate assumptions

	Unorganised (%)				Total Economy (%)			
Items/ crops	g_1	g_3	g_2	g_0	g_1	g_3	g_2	g_0
Milled Rice	0.333	0.287	0.320	0.423	1.80	1.75	1.78	1.89
Milled Wheat	0.428	0.369	0.412	0.865	3.08	3.02	3.06	3.52
Milled Coarse Cereals	0.333	0.287	0.320	0.490	23.23	23.21	23.22	23.30
Milled Pulses	0.403	0.347	0.387	1.308	11.37	11.25	11.33	13.37
Groundnut	1.206	1.038	1.159	1.042	5.82	5.65	5.77	5.66
Soybean	0.018	0.015	0.017	0.081	34.89	34.89	34.89	34.96
Edible Oil	0.139	0.120	0.134	0.140	10.29	10.27	10.29	10.29
Fruits	0.022	0.019	0.021	0.024	2.42	2.42	2.42	2.42
Vegetables	0.017	0.015	0.017	0.014	2.27	2.26	2.27	2.26
Spices	0.403	0.347	0.387	0.854	10.67	10.62	10.66	11.12
Fish	0.411	0.354	0.395	0.287	7.66	7.60	7.64	7.53
Fresh Milk	0.429	0.369	0.412	0.234	5.72	5.66	5.70	5.52
Egg	2.349	2.022	2.257	5.002	5.17	4.84	5.08	7.82
Sugar	0.087	0.075	0.084	0.007	0.13	0.12	0.13	0.05
Meat	0.002	0.002	0.002	0.005	11.37	11.37	11.37	11.37

Sources: Computed from unit level data of ASI and NSSO, MOA data

Table A 5.6: Quantity of selected agro-products processed in 2010-11 in the unorganized sector and the combined sector: Projection based on alternative assumptions of input growth rates.

	Million tonnes (Unorganised)				Million tonnes (Total Economy)			
Items/ crops	g_1	g_3	g_2	g_0	g_1	g_3	g_2	g_0
Milled Rice	0.2547	0.2193	0.2448	0.3233	1.37	1.34	1.36	1.44
Milled Wheat	0.2941	0.2532	0.2826	0.5938	2.12	2.07	2.10	2.41
Milled Coarse Cereals	0.0391	0.0337	0.0376	0.0576	6.02	6.02	6.02	6.04
Milled Pulses	0.1044	0.0899	0.1003	0.3391	1.34	1.32	1.33	1.57
Groundnut	0.0589	0.0507	0.0566	0.0509	0.28	0.28	0.28	0.28
Soybean	0.0017	0.0014	0.0016	0.0075	3.26	3.26	3.26	3.27
Edible Oil	0.0072	0.0062	0.0070	0.0073	0.54	0.54	0.54	0.54
Fruits	0.0044	0.0038	0.0042	0.0046	0.47	0.47	0.47	0.47
Vegetables	0.0106	0.0091	0.0102	0.0086	1.40	1.39	1.40	1.39
Spices	0.0134	0.0115	0.0128	0.0283	0.35	0.35	0.35	0.37
Fish	0.0320	0.0276	0.0308	0.0223	0.60	0.59	0.60	0.59
Fresh Milk	0.4440	0.3823	0.4267	0.2420	5.92	5.85	5.90	5.71
Egg	0.0644	0.0555	0.0619	0.1372	0.14	0.13	0.14	0.21
Sugar	0.2333	0.2009	0.2242	0.0173	0.35	0.32	0.34	0.14
Meat	0.0001	0.0001	0.0001	0.0003	0.61	0.61	0.61	0.61

Note: All agro-processing activities are considered. For the selected items see Table 4.3. Sources: Computed from unit level data of ASI and NSSO, MOA data

Table A5.7: Gross Production of Different agro-items. (in million tonnes)

Crops	2003-04	2004-05	2009-10
Rice	71.8 (22.8)	83.1 (24.7)	89.1 (26.8)
Wheat	65.7 (16.0)	68.6 (17.2)	80.8 (28.9)
Fruits	45.2	50.8	71.5
Vegetables	84.8	101.3	133.7
Spices	3.7	4.0	4.0
Coarse cereals	26.1	33.5	33.6
Pulses	11.1	13.1	14.6
Edible Oils	3.6	6.1	5.9

Note: Values in parenthesis are government procured quantities. Sources: MOA data

Table A 5.8: Consistency check for the estimate of Basic processing of Rice and Wheat (quantity in Million tonnes)

		Production	Sales to Government	Seed Feed Wastage	Farm Retention	Sale to Cooperatives	Direct sales	Rural Consumption (Non-PDS)	Surplus (open Market sale)		Estimate of raw processing
		MoA	MoA	CIPHET	DMI	DMI	DMI	NSSO	Estimate 1	Estimate 2	Our estimate (Basic and value added)
		A	B	C	D	E	F	G			
Rice	2005-06	91.79	15.21	13.03	27.39	3.58	3.34	52.14	29.23	11.40	19.85
	2010-11	95.98	17.74	13.63	28.64	3.74	3.49	45.77	28.73	18.84	20.16
Wheat	2005-06	69.35	14.79	10.40	21.85	6.53	10.10	36.61	5.68	7.54	10.09
	2010-11	86.87	25.92	13.03	27.36	8.18	12.65	36.20	-0.28	11.72	7.15

Notes on Assumptions and specifications:

1. Sales to government: (100-43)%=57% of total procurement based on Gupta (2013); for wheat 100% of procurement is from farmers
2. Seed Feed Wastage: 3%, 6% for seed and Feed respectively and Wastage from CIPHET
3. Farm retention: Farm family consumption-Rice:26.08%, Wheat:27.49%; permanent and temporary labour consumption-Rice:2.22% and Wheat:2.13%; for payment in cash and kind-Rice:1.54% and Wheat: 1.88%
4. Direct sales- Rice: 3.64% and Wheat: 14.56%
5. Sale to cooperatives- Rice: 3.9% and Wheat: 9.42%
6. Rural household consumption assumed to be farm consumption and all other unmilled grain sale directly for consumption is per capita rural household consumption from sources other than PDS- Rice: 5.54 kg in 2004-05; 4.59 kg in 2009-10 Wheat (atta): per capita rural consumption from non-PDS sources, 2004-05=3.89 kg; 2009-10=3.63 kg. Estimate 1: A-B-C-D-E-F, Estimate 2: A-B-C-G. Sources: Directorate of Marketing and Inspection, Ministry of Agriculture (2005), Agricultural statistics at a Glance (2013).

Appendix 6

Comments and Responses:

The results were discussed at various stages of analysis and suggestion offered by MOFPI and experts taken into account. The draft report was presented at MOFPI and also sent for peer review.

A6.1: Suggestions received at latest meeting held at Ministry of Food Processing Industries (Economic Trade and Investment Division) Panchsheel Bhawan, August Kranti Marg, New Delhi-110049 in March 2014

1. **Comment:** The survey of literature given for Russia, America, Africa and Asia has not much of relevance as there is neither any details of estimates nor methodology adopted. It was also desired that the methodology by other countries if available for estimating the extent of processing of their agricultural commodities may be incorporated in detail in the report.

   Response: The review is now shortened and focused considerably as suggested.
2. **Comment:** All the references attributed to Ministry of Food Processing on the extent of food processing in the draft report should be deleted as the Ministry has not made any such estimation.

   Response: Done.
3. **Comment:** It was suggested that either FAOSTAT data should be analyzed using Time series method or be deleted.

   Response: Time series data for 2000s decade is given in the way suggested at the meeting and discussed analytically.
4. **Comment:** The study should include different tables for registered, unregistered and overall sector for two level of processing i.e. basic processing and value added processing for two different reference periods 2005-06 and 2010-11, in the report.

   Response: The statistics are presented.
5. **Comment:** IEG was asked to explore the reasons behind the fluctuation and document the same in the report.

   Response: Discussions made, specifically on processing of oils
6. **Comment:** In the Table 5.5 "User Industries of inputs from Agriculture" major sub-sectors should be accompanied by respective NIC code.

   Response: Respective NIC codes given.

A6.2: Review comment by ISEC received at 6th May, 2014

Review Report

1. **Title** of the Draft Study Report Examined: The Extent of Processing of Agricultural Products in India

2. **Date of Receipt of the Draft Report**: February 13, 2014

3. **Date of Dispatch of comments**: May 06, 2014

4. **Comments on the Objectives of the study**: The objectives of the study are clear; specific and very relevant to the topic. The objective of the study is to make fair estimates of the extent of processing of agricultural products in India especially agricultural products that enter industry as inputs.

5. **Comments on the Methodology**: The major problem faced by the researcher is to estimate the quantum of agricultural produce that goes into value addition through processing as we do not have good data base for estimation. The author has taken pains to devise a methodology through discussions with different stake holders and experts from different fields related to food processing industry and also statistical organizations engaged in data collection. I congratulate the author for the efforts taken to synthesize/ finalize the methodology for estimation of agricultural products being processed in India.

6. **Comments on Presentation**: The Report is organized into 5 chapters. Brief introduction covering diversification & commercialization of agriculture and importance of food processing in the changing economy. The objective of the study as well as data sources are also provided in the first chapter. Chapter 2 provides brief review of literature related to food processing sector under different sub-heads. An overview of India's Food Processing sector, policy and performance, constraints, etc are discussed in Chapter 3. Chapter 4 presents information on data set used for estimation and discusses the methodology used at arriving the estimates of agriculture produce used by processing industries. Finally, the estimates of extent of food processing by crop are provided in Chapter 5. The core chapter is supported by a good number of annexure.

Thus, a comprehensive work has been done for assessing the quantum of agriculture produce used by food processing industry in India. Over and above the estimates, it is the refinement of methodology developed for such estimation.

7.**Overall View on Acceptability of the Report**: The report is very interesting and timely and can be accepted for publication

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