

VALUE CHAIN *led*
AGRICULTURE & FOOD SCIENCE
***for* BETTER NUTRITION**

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Hon. President of International Union of Food Science and Technology (IUFoST) (2020-2022)

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Director of CFTRI, Mysore, India (1994-2011)

President, Nutrition Society of India (2008-2012)

Panel Leader of CFS - HLPE on Food Losses and Waste (2016)

Padmashree Awardee, Bhatnagar Awardee of India and 73 other Industry and Academia Awards

Seven Lifetime Achievement Awardee Globally and Nationally

Fellow of Academies Nationally and Globally (IAFoST, FRSC, NAAS, IAS, NASI, AFSTI, IFT, INAE)

Food Chain and Processing

- Agriculture
 - Harvesting
 - Transportation
 - Primary Processing
 - Secondary Processing
 - Tertiary Processing
 - Quaternary Processing
 - Refined Foods
 - Co-products & By product Utilisation
 - Smart Food Processing
- Understanding Food Properties for Quality ?
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Basic Food Categories / Groups

- Grains (Green Revolution)
- Fruits & Vegetables (Rainbow Revolution)
- Dairy Products (White Revolution)
- Meat, *Fish* & Poultry (*Grey Revolution*)
- Spices, Herbs Condiments and medicinal plants (Health and Wellness revolution ?)
- **FOOD IS THY MEDICINE !**

THE PARAMETERS THAT AFFECT THE AGENDA OF INNOVATION, RESEARCH AND DEVELOPMENT!

**Indigenous Agri material
Traditional knowledge &
energy resource**

**Socio-Economic
imperatives**

**Research &
Development**

**Internal & External
markets**

Fiscal policies

Human Resources

Trade & Economic blocks

**Cost effectiveness & local
sustainability and Sustainable
Consumption**

Focus of Presentation

- **Translational and Value Chain Agriculture and Food science and Food Technology will not only depend upon Composition but but also *Computational data analytics* to synchronise the best property it can use as a co functional food ingredient for better Nutrition.**
- **The power of *Chemistry* and basic sciences having an integrated approach using Biotechnological approaches and Enzymology for leveraging *functional genomics opens up New Vista and possibilities.***
- **The right varieties for Processing *Versus* table Variety (Example : Fruits and Vegetables)**
- **Understanding property-structure-function relationships.**
- **Modulating Food for Health wellness from better Nutrition.**

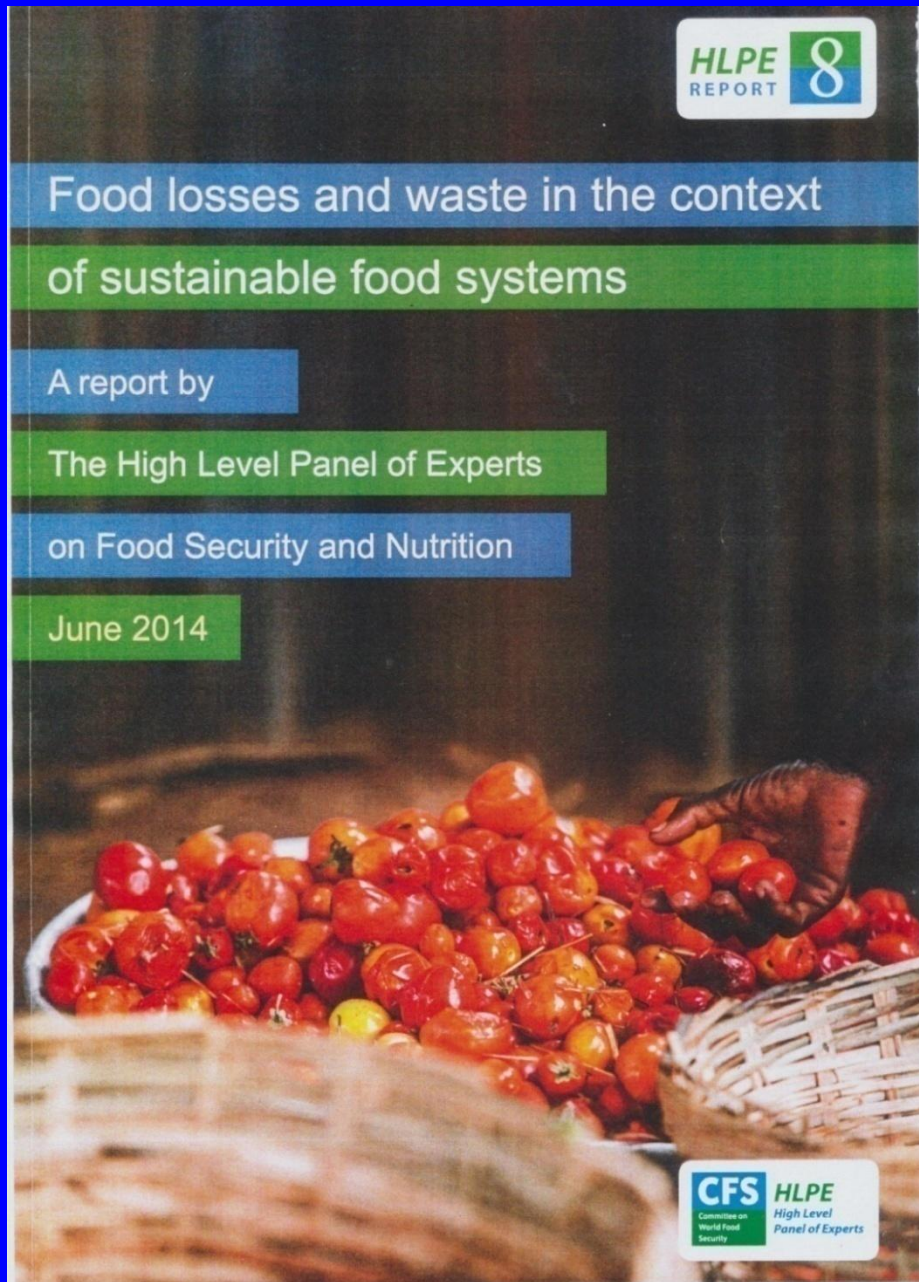
The Shift in Value Chain led Agriculture and Food Science

- Moving from "Nutrient Composition" (what is in the food) to "Food Architecture" (how it is put together) is of interest.
- Key concept: The Food Matrix effect
- The primary role of Food Science is to provide better Nutrition but it also facilitates different natural and *induced Properties to Food with dense Nutrients*.
- This also applies to combination with other foods for *Functional Properties* for health and wellness.

Defining Food Architecture

- Hierarchical structures: From molecular (nanometer) to macroscopic (millimeter).
- These are measurable with the latest tools of Chemistry and other measurements at molecular level and gives a handle to innovate and modify the properties of a food to the desired end product using current knowledge of *AI and Nanotechnology*.
- The Traditional Foods of a region has a fundamental bearing on this aspect based on its sustainability over thousands of years of distilled wisdom of *observational Agriculture & Food Science and Technology* and today the modern scientific tools are *unravelling the power of such Big data of Food for Health*.

A Word about Food Losses and Waste !



By

V Prakash

Project Team leader

Report released at FAO

in Rome

(Being updated)

www.fao/cfs/cfs-hlpe

Traditional, Indigenous and Ethnic Foods (TIEF)

- Thousands of years India has good documentation through various works of
Charaka Samhita
Sushruta, Bhavaprakasha, Madhava
Aaaharadhikaranam
Bhojanakutuhalam
Kshema Ahaara (Safe Food)

Which comprises of 5000 years of TIEF in India. The traditional, Ethnic, Heritage and Indigenous Food are well documented.

- There are many other countries in and around Mid west, Meditteranean, Africa, Central America (Maya civilization), Latin America which also has a huge epidemiology of TIEF and strong base in Health and Food like India.
- Today we are capturing this knowledge with Palm Scripts digitization, huge number of books which covers only a few areas still to share knowledge digitally.

ELSEVIER TRADITIONAL AND ETHNIC FOOD SERIES

NUTRITIONAL AND HEALTH ASPECTS OF FOOD IN SOUTH ASIAN COUNTRIES



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Science of Nutrition

- **Nutrigenomics**
- **Traditional Herbs and Gene Regulation**
- **Precision Population Nutrition, Personalised Nutrition and planetary nutrition**
- **Reverse Nutraceuticals : Advocacy for a New Path**
- **Components of Reverse Nutraceuticals need many attempts to evaluate epidemiological data**
- **Nutrition based Pharma**
- **Renaissance in Ayurceuticals with evidence and science based approach.**

Herbaceuticals

- Beginning of the Journey of

Nutraceuticals

Edited by
V. Prakash, FRSC & D.B.A. Narayana, PHD



IFRIFANS, Mysuru, India
& Ayurvedye Trust, Bengaluru, India, 2019

Examples of Models Interesting to study to generate more data from such daily happenings in India

- Milk revolution in India
- Lunch Box and Mumbai
- Mid day meals in schools
- Education in India
- Trains in India
- Consumer markets in India
- Agriculture in India especially marginal farmers.
- Small Scale Industries
- Microenterpreneurs
- Funding, VC's, Banks, Govt. support *etc*

FOOD CULTURE from Agriculture

- These Indigenous Food Culture paves way for adaptation to Climate change and changing lifestyle cultures in a particular region for emergence of new and *innovative Fabricated Functional Foods (3F) or New Designer Foods stemming from newer lines from Modern Agriculture.*
- *These are based on targeted Food Properties in the food matrix and driven by affordability of the final product for ease and convenience of modern fast life but yet can have a traditional lunch in the office !!*
- Rheology, texture, and thermal properties, sensorial GMT!
- How water activity (a_w) affects structural stability and Clathrate structure of water in germination all the way to preservation of Nutrients in Food Processing.

Contd..

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- **With the demand of products beyond market forecasting the evolution of *Food ingredients indeed stems from basic properties* of Food and its modification by physical, chemical or green processes and precision Agriculture & Food Science is the Game Changer for tomorrow's dynamic market.**
- **Protecting bioactive compounds (e.g., Omega-3, probiotics) within the architecture cage of Agriculture, through Biotechnological approaches.**
- **Ensuring survival through the upper GI tract for Bio-actives and nutrients are fascinating newer areas of Research.**

Structuring Food for Health & Wellness (Ex: Satiety)

- **Controlling gastric emptying rates through gelation.**
- **How structure influences "fullness" via mimicking food molecules for connecting gut brain axis.?**

Glycemic Control via Food Properties and Architecture

- **Encapsulating starches to slow down enzymatic hydrolysis.**
- **The "Slow-Carb" approach to preventing insulin spikes are a few examples of Food for Health & Wellness.**

Bioavailability vs. Bio-accessibility

- **Definitions: Is the nutrient released? Is it absorbed? How much is excreted? Precursors?**
- **How the matrix controls the "Release Profile for Sustained release or many times no release at all."**

Precision Nutrition and Targeted Delivery

- **Enhancing Functional attributes of Future Foods to *Personalise Foods on individual physiological basis* has great promise in the market dynamics including designer foods for an individual especially in Clinical Nutrition (Ex: avoiding food specific allergens for an individual.)**
- **Designing foods for specific demographics (e.g., elderly-friendly textures, infant formulas etc).**

The Gut Microbiome Interface

- The era of Probiotics has engulfed Pre and Postbiotics also for *Gut Health* arising out of a food based approach.
- Food Architecture that delivers Pre, Pro and Post - biotics to the colon.
- Fermentation kinetics based on particle size and porosity of Traditional foods.

Oral Processing and Sensory Perception

- How properties and structure dictate flavor release?
- Reducing salt/sugar without compromising taste by strategic spatial distribution (Role of Chemistry and taste for better absorption)

SUSTAINABLE DEVELOPMENT GOALS



The Future of Agri. – Food Science – Nutrition

Challenges in Sustainable Development Goals (SDG's) agenda

- Clean label requirements (reducing synthetic additives).
(More Eco and More Naturals)
- Cost-effectiveness of advanced Food structuring technologies in a product. The game changer of More from Less for More from water in Agri to nano nutrients in Nutrition !

The Future: Digital Gastronomy

- AI-driven food design and personalized food structures for Healthy Nutrition.
- This will also form the key elements for the future of *Importance of Food with Precision Nutrition* enchanted with regional and local branding with local agri products. The 15 to 50 kms radius eco-system and Green technology is the way forward for symbiosis with nature !?

Conclusion & Take-Office Message

- **Structure and Properties are as important as Ingredients in the case of Foods.**
- **The Safe Food package ultimately perhaps comes with protection of Trademarks, IPR issues, GI and GA tags and market induced Agri. production in the Food Chain for better profit to the Farmer. The manufacturer with good regulatory practices must obtain a *Diversified Food Plate for the Consumer which is Healthy and Affordable and nutrient dense.***
- **Sustainable health from Food based approach requires a multidisciplinary approach from Agriculture to Nutrition via Food Processing.**
- **Physics + Chemistry + Biology + Physiology.**
- ***This Innovative thinking can lead to Safe and Sustainable Functional Foods for Health and Wellness from Paediatrics to Geriatrics with value chain led Agriculture & Food Science for better Nutrition.***

Thank you

