

The Need for Automation in the Domestic Food Processing Sector and its Impact

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Abstract—The Objective of this study is to address the critical need for automation in the domestic food processing sector and to study its impact.

This study investigates the challenges arising out due to the dependency of the modern human for processing of food. Through the medium of this study a pressing need for the development of an automatic cooking machine is proposed. The impact of the development of this product has also been profoundly discussed.

Keywords—Automation, Food Processing, Impact on Economy, Processing Individual.

I. INTRODUCTION

Food is the one of the most basic physiological needs essential for the survival of a living being. Some of the living beings have the capacity to prepare their own food (like most plants) and therefore are designated as primary food producers. Those who depend on these primary food producers for food form the primary consumers' class (herbivores). Some of the organisms relying on these primary consumers are the secondary food consumers (carnivores). There is a third category of consumers called tertiary food consumers/apex food consumers that feed on both the primary food producers and the primary and secondary food consumers. Humans form an essential part of the apex predators and are generally at the top of the food chain [1][2][3].

The early stages of the evolution of the modern human can be traced back to the times when the fire was discovered. This discovery also paved the way for the earliest form of food processing. In the present days, the old notion of eating raw/brute food is long gone and food processing has become very trenchant in the lives of the modern human. The food habits of the modern human i.e. Homo sapiens sapiens, reveals that they depend on other individuals for preparing their own food. There is an increase in dependence on these "processing individuals" for preparing the food before the modern human can consume it. It has created a further shift between the primitive and the modern human in the food chain hierarchy. The effects of this shift are systematically investigated in this study.

The processing of food has a direct impact on the economy of the individual (consumer). Also, most of the individuals depend on other processing individuals for the preparation of food. This dependency has lead to the establishment of a vital link of dependency in the food web (as shown in Fig 1.) which when altered can adversely affect the food web.

Manuscript received August 06, 2015; revised August 15, 2015
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Assumption

Those individuals who process the food also consume the food that they process. (They are termed as "processing individuals" or "self-reliant "modern human beings.)

Extreme Case

The conventional hierarchy of the food chain (without taking into account the affect the shift between primitive and modern human) is based on the extreme case of survival needs, but as the modern human evolves/develops there is a creation of plethora of needs that needs to be addressed. The failure to assuage these needs might not lead to the death of an individual but can significantly shape its habitat and affect its evolution in the longer run.

II. PROCESSING OF FOOD

Food Processing is a technique to convert raw ingredients into consumable food form (by the modern human). It typically involves operations and activities such as mincing, macerating, boiling, emulsification, pickling, canning, etc.

Presently, the processing of food mainly takes place at two major processing stages i.e. at the industry and at the domestic level.

The agricultural produce provides the basic raw ingredients that undergo processing in the subsequent levels as shown in Fig. 2.

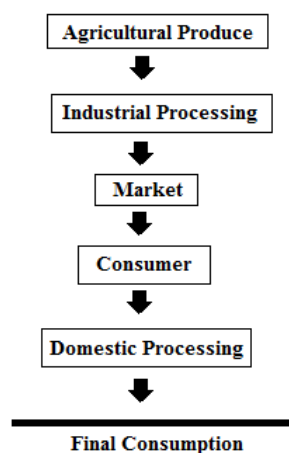


Fig. 2. Stage of Food Processing

Industrial food processing includes the production of marketable food (purchased by consumers) from raw ingredients provided by agricultural produce. It includes a variety of operations such as the addition of chemical ingredients, filtering, packaging, etc.

In conventional times, the primary rationale behind industrial processing of food was to preserve the food for a longer duration and ensure its supply round the year. Various methods such use of additives, salt, cold storage, etc. were employed to preserve the food.

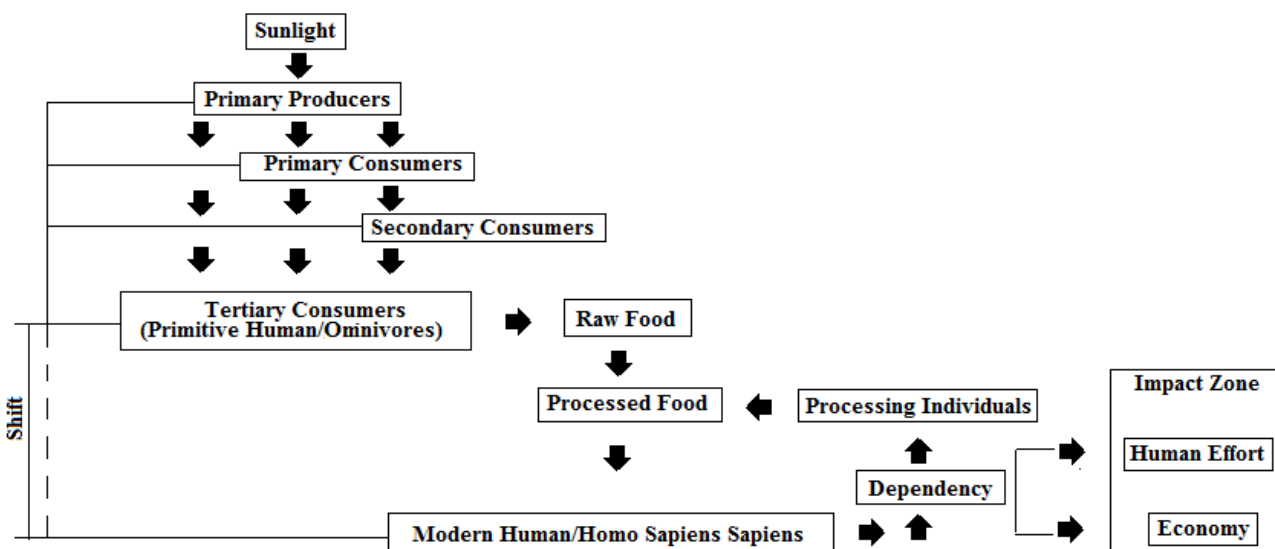


Fig. 1. A typical Food Web for the Modern Human

Later, the use of vacuum containers started to preserve the food and to inhibit the growth of microorganisms that can severely reduce the shelf life of food [4]. This gave rise to the canning industry. The canning of food also provides a great deal of ease in the transportation of food.

Apart from the aforementioned factors for processing the food, the modern day food processing is also done to provide convenience in processing food at the domestic level and for accommodating the preferences (such as taste, color, etc.) of the consumer.

The processed and packaged food from the industry is then supplied to the market for purchase by consumer. The consumer further processes the food domestically before final consumption.

III. EFFECTS OF WIDENING OF GAP BETWEEN THE PRIMITIVE HUMAN AND THE MODERN HUMAN IN THE FOOD WEB

A. Human Effort

A lot of effort is required by an individual to process and prepare the food. This includes consumption of energy while transporting raw materials, chopping them, monitoring the process till the end, stirring the contents, cleaning, etc.

Thus, a processing individual devotes a lot of time and effort in the aforementioned processes. It can exhaust an individual and make him/her tiresome affecting his/her other endeavors. Some old aged people who form a part of the “processing individuals group” can have an extremely hard time preparing food requiring strenuous efforts.

The high frequency of consumption of meals (greater than 2 times a day) makes it even more laborious for the processing individuals.

B. Economy

As more and more individuals experience the shift between the modern and primitive human, a lot of them are coerced to form a part of the transitional gap between them i.e. they are required to form a part of the processing individuals’ group and process food for other individuals.

There is an ambiguity about the role of these “processing individuals”, some argue that the work they do is part of

their social responsibility while some term it as fate. But there is a flip side too, where this work is quite rewarding. The reward can be an abstract feeling of utmost satisfaction or can have some monetary value. It is essential to note that since in most of the cases this work is not “rewarding”, an individual indulged in this case shall experience a loss in opportunity to do some economic activity (a work that is rewarding). This adds to the detrimental effect on the economy of the processing individual as he doesn’t get any remuneration for his job.

An interesting thing to note is that while the activity may not be rewarding for some of the individuals who processes food but is highly productive for other individuals/group of individuals who depend on these processing individuals for their food. But in some cases the dependent individual might have to hire a processing individual for the preparation of his/her food. This adds to the economic burden of the dependent individual.

C. Potential Threats of Excessive Reliance

The processing individuals are the vital link for providing processed food to the modern human. Therefore, there is an excessive reliance on these processing individuals. This excessive reliance has the potential to severely damage the food web of all the individuals in case of failure/wearing of this link. The fact that modern human consumes food at a high frequency (generally 3 times a day or even more) there are high chances for degrading of this link. An absence marked by a mild sickness of the processing individual could disturb the whole web of food consumption.

The demands of an ever increasing population can not merely be met by depending upon these processing individuals. Hence, this excessive reliance on a few individuals could prove to be fatal.

III. PROPOSED SOLUTION

It is quite evident from the aforementioned effects that there is a critical need for development of an Automatic Cooking Machine (ACM) that could process and prepare the food and eliminate the dependency on the processing individual(s) so as to protect the mankind from the detrimental effects of the widening gap between the primitive and modern human. This calls for automation at the domestic level.

Presently, the outlook of automation is limited to the industrial level. It is driven by motives such as decreasing production time, mass production, cost cutting, avoiding human interference, performing specialized operation, etc [5][6]. And despite this the end consumer still has to process the food further before final consumption. Thus, it doesn't provide a complete wholesome solution to the problem.

Whereas, the proposed route of automation at the domestic platform via Automatic Cooking Machine (ACM) eliminates the need for industrial processing (which is done just to provide convenience in processing at the domestic level). It processes the food completely (without any human interference) at the domestic level and makes it ready for final consumption. It provides a holistic solution towards addressing the problem and, therefore, is comparatively a better alternative.

Automating the food preparation process at the domestic platforms (household, restaurants, etc.) shall significantly help to reduce human effort, bring down the cost of food, and eliminate the dependency on other processing individuals.

Henceforth, it provides a dependable solution to protect the humans from the potential detrimental effects of widening gap between the primitive and modern human.

IV. IMPACT

A. Quality of Food

The nutrient density is typically an indicator of the proportion of nutrients present in a food item and can be selected as a measure of the quality of food. The nutrient content composition changes in food items depend upon the particular nutrient, the commodity, post-harvest handling, storage and home cooking conditions [7]. The time between the harvest and the final consumption also significantly affects the quality of food.

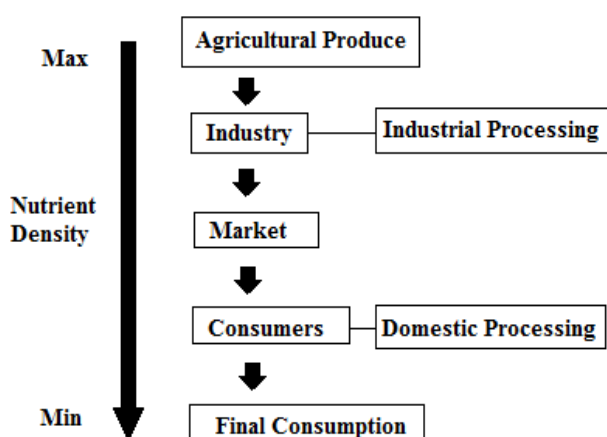


Fig. 3. Effect on Nutrient Density when processing food through industrial processing

In processing the food at the industry, there is a significant loss in the nutrient density of the food [7][8][9]. In the canning of food, the ingredients are subjected to a high degree of temperature that might lead to degradation of vitamin C present in it [9]. It is quite challenging to maintain the appropriate conditions such as pressure, relative humidity, temperature, etc., while storage of food is considered. Use of food additives in the industry represents

another safety concern. Various Food Safety bodies monitor the level of chemical ingredients added while industrial processing but affirming to the rules and standards regulated by them is in itself a major challenge.

The effect of food processing on the nutrient density through the conventional route of industrial processing is shown in Fig. 3.

Food processing through Automatic Cooking Machine (ACM) involves processing of food at domestic platforms by directly using agricultural produce as raw inputs. It provides single stage processing of food compared to the dual stage processing adopted in the conventional route.

The total time elapsed between the harvest and the consumption is much lesser in this route compared to that of the conventional route involving industrial processing.

Thus, it provides a comparatively better route to maintain the nutrient density of a food item as shown in Fig. 4.

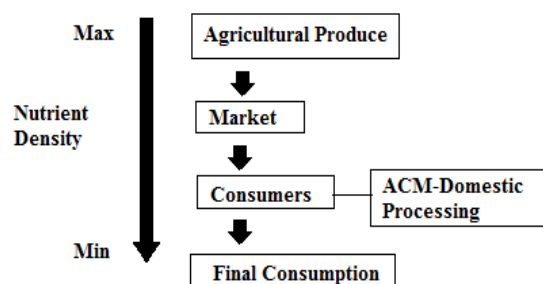


Fig. 4. Effect on Nutrient Density when processing food through ACM

B. Social Impact

The Automatic Cooking Machine (ACM) shall relieve the burden of cooking on the processing individuals. Those processing individuals who don't get paid for their work can look for other economic opportunities. A lot of time and human effort can be saved by adopting this path.

In societies where women are bound by obligations to prepare food for the family shall be free of their burden. This shall help in raising their status quo in the society and add to the larger cause of women empowerment.

C. Cost of Food

In various developing countries the percentage of income spent on food along with malnutrition rate is quite high [10] [11]. Around 795 million people in the world do not have enough food to lead a healthy active life [12]. That's nearly about one in nine people on earth. The incessantly increasing population and consumption growth shall lead to a high global demand for food in next 40 years [13]. The existing setup cannot cope with this demand and to combat with these problems the cost of food has to be drastically reduced.

The cost of food by industrial processing involves the cost of processing at both the industrial and domestic level as shown in Fig. 5.

Since the processing through ACM takes place at domestic level itself (as shown in Fig. 6.) it can effectively help to cut down the cost incurred to the final consumer due to food services, food processing done at industry for convenience at domestic platforms, etc.

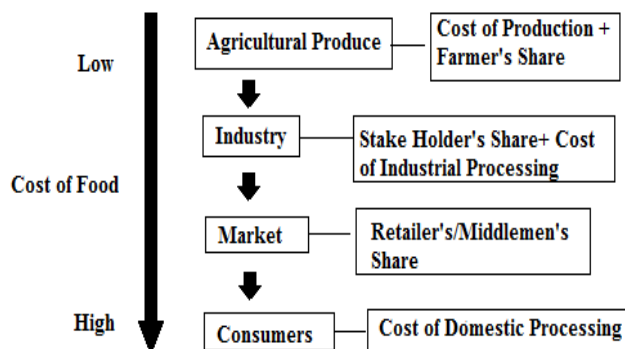


Fig. 5. Cost of Food by Industrial Processing

Thus, domestic food processing by ACM is highly likely to bring down the cost of food and is certain to improve the health of individuals as it helps to maintain higher nutrient density than the industrial food processing as shown in Fig. 5., Fig. 6., Fig. 3. and Fig. 4. respectively.

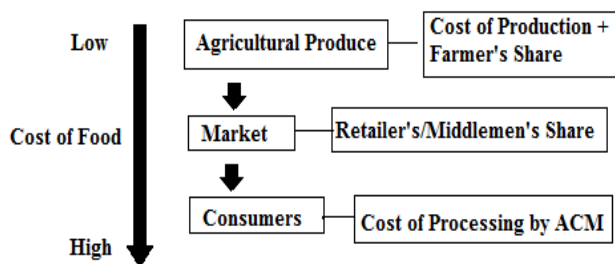


Fig. 6. Cost of Food on Processing by ACM

V. CONCLUSIONS

The increase in dependency for processing food could prove to be fatal for the modern human beings i.e. Homo sapiens sapiens and hence an independent automated system needs to be developed to process the food at the domestic level. This in turn shall eliminate the dependency on processing individuals.

More research needs to be done regarding automation at the domestic level. One has to look beyond individual automation units and incorporate a holistic approach.

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