

THE ROLE OF INFORMATION TECHNOLOGY (IT) IN FOOD SYSTEMS SUSTAINABILITY¹

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ABSTRACT

Information technology (IT) is a discipline which can be applied in various fields and areas for improvement of food systems. By strengthening the food technology, IT can contribute in order to meet industry needs in the country and worldwide. The main goal of this research was to introduce contemporary methods and techniques which are coupled with IT not only to obtain new food products, but also to determine the content of the products. The production of nutritionally redefined, food products can be facilitated with coupling food production systems with IT equipment and technology. With this goals achieved food products at the same time will have, structure, appearance, taste and value acceptable for the stakeholders. Moreover, packaging sensors, 3D printing of food products, as well as development and validation of certain method for determination of food content e.g. NIR spectroscopy can be introduced and applied for sustainability in food science and technology.

¹ professional paper

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Introduction

There is an increasing need for the food industry to provide information on their products in order to satisfy quality standards and to protect their products from food fraud. Recent developments in IT, and advances in big data analytics, provide the opportunity for step-changes that can transform the role of food integrity assurance from one of just strictly conformance to one that addresses a wide range of business critical concerns, including quality, safety and authenticity solutions.

Cold treatment processes are very important in the field of food preservation, reliability of the product and extending shelf life. Nowadays large percentage of people knows how important is healthy diet on general health, thus the demand of quality food products is very high. Information that packaging of food product gives to the customers carry essential information about food quality and safety. Smart packaging integrated sensors or indicators provide information about the integrity and the time–temperature history of the food package. This is important for sustainable development of supply and demand, because on one side the demand of fresh food products comes from the consumers, and on the other side information about shelf life will lead to financial benefit for the companies, informing customers about freshness level of food product and also it will have impact on decreasing of food waste.

Today's consumers are concerned with global warming, animal welfare and healthy eating. Meat production is a major contributor to greenhouse gases, and increasing household income and urbanization has caused the demand for meat and meat products to continue to grow. Plant based meat products are the key for improvement of climate conditions and also will have impact on

general people health because they will reduce the already high daily intake of meat in many countries around the world.

Quality assessment of food products with non-destructive techniques

Near Infrared, or NIR, spectroscopy is an analysis technique for fast, accurate food testing. Food quality is a critical issue in the food and beverage and agricultural sectors, and food contamination is a continuing issue, with meat and alcohol being two of the most frequently adulterated items. Food suppliers, retailers and their customers all need to have complete confidence in the food that is readily available, on a domestic and global scale. NIR measurement is highly effective in the quality control of a broad range of foodstuffs and supports various aspects of food processing, including: Identifying ingredients and additives, Composition analysis for food labelling, Detecting food fraud, Optimizing manufacturing and production processes. Potential applications in food analysis have attracted a great deal of attention, due to the availability and applicability of various calibration methods together with the development of modern computer science¹. According to the realization of process implementation, off-line, at-line, on-line, and in-line measurements can be distinguished^{2,3,4}.

Innovations in food packaging – Smart time temperature indicator (TTI)

Inappropriate storage and manipulation of food products leads to decreasing initial quality parameters and shelf life, so this means increased food waste. Wasting food is not only an ethical and economic issue but it also depletes the environment of limited natural resources (i.e. water, energy, chemical substances and materials). Annually 1.3 billion tons of food are being wasted⁵. All actors in the food chain have a role to play in preventing and reducing food waste, from producers and processors of food to

retailers and consumers, the relevance of household waste suggest that advances in packaging can be an essential tool to reduce food waste. The percentage of waste varies with values from 20% for beef meat to 35% for fishery products or 45% for fruits and vegetables⁶. Time temperature indicators are available and in use worldwide in food industry for fresh products⁷. The principle and mechanism of this indicators is based generally on mechanic, enzymatic or chemical reactions⁸ that are sensitive on different temperature and storage conditions so they can imitate the shelf life of the product. Pairing mobile application with TTI will have the ability to transmit all missing parts of conventional food packaging. Manual for reading the changes that smart label give to customers in real time. Marketing of the company that produces or process that food product will all information and video for the preparation process of that food product, new technologies in the company, some awards that the company will receive etc. Information about elementary chemical composition of food product and useful information about the ingredients related to healthy diet (ex. unsaturated fatty acids reduce the risk of heart disease and lower cholesterol levels (among other health benefits) when they replace saturated fats in the diet). Over 99% of fresh meat and fish products need to be prepared with heat treatment before consuming, so the recipe book can be included. Consumer concerns and reserves will be solved with full transparency of the production of TTI, and information that TTI will give in real time. Beside the smart information about food product that TTI will give to consumers, it can guarantee in any time, that product is fresh and safe for consuming, or contrary the product isn't safe for consuming if that's the case.

Policy makers will be satisfied with commercialization and wide use of smart TTI label because of all positive aspects that TTI application will bring to the consumers, ecosystem, decreasing of food waste, which leads to a reduction in environmental pollution. By meeting all these challenges TTI application in fresh food packaging will meet positive reviews among customers, NGO and non NGO organizations focused on eco-awareness.

Redefined food products – 3D food printing

Three-dimensional (3D) printing, also known as additive manufacturing solid free-form fabrication, was first introduced in the food sector by researchers from Cornell University using an extrusion-based printer (Fab@home)⁹. This technology is characterized by a layer-by-layer material deposition mode based directly from a predesigned file^{10,11}. 3D printing offers improvement in food technology in several aspects. Design that can be reached with 3D printing, cannot be achieved by manual labor or conventional mold can be produced by ordinary people based on predetermined data files that comprise culinary knowledge and artistic skills from chefs, nutrition experts and food designers¹². 3D food printing 3D food printing permits digitization and personalization of the nutrition and energy requirements of an individual person according to their physical and nutrition status^{13,14,15}. Application of these techniques will move manufacturing closer to the needs of consumers and suppliers and will reduce transportation costs^{16,17}. Food printing technology will also broaden the source of available food material by using nontraditional food materials such as insects, high-fiber plant-based materials and plant- and animal-based by-products^{18,19}. Currently, 3D printing techniques available in the food sector generally include four types: extrusion-based printing, selective sintering printing (SLS), binder jetting and inkjet printing.

Conclusions

The application of NIR spectroscopy in the food sector looks back on a long history. Rapid analyses without the need of sample preparation presents one of the main advantages of this technique.

With application of TTI smart label, companies in food industry will eliminate the possibility of deterioration in initial qualitative properties of their product which are caused by improper handling in the food supply chain or in the retailer stores.

One of the advantages of 3D printing is to fabricate an exquisite and fascinating structure of edible products to increase consumers' interest and appetites. Improving production efficiency can reduce production costs

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