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Recent And Expected Trends For Dairy Industry

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Abstract

Recently, future projection studies in the food industry have been very important in order to take correct position and to make correct planning for investment, product development and research&development activities. Dairy industry and its products are quite important for humankind because not only providing important nutrients for them, but also providing livelihood for most of the people around the world. Today's world earnings of the people is increased by time and this is a reason to disburse for more healthier and nutritious foods. Dairy products are one of these foods and demand increases by time. The aim of this study is to give a perspective for the future of dairy industry depending on different aspects such as expected technological developments, demanding trends, economic trends and expected products in the future of this industry and whole lot more.

Keywords: Dairy industry, future, predictions, 2050, foresights

INTRODUCTION

Dairy is a strategic sector at the global scale. It contributes to the improvement of many national and local economies, and has a very important social impact [1]. Dairy products have been long history since nearly beginning of the humankind as early as 4000 BC as evidenced by rock drawings from the Sahara [2]. Dairy products are highly nutritious [3]. Milk is the raw material of a major dairy processing industry [4]. Production of milk around the world is dominated by cow's milk [5]. Expectations about dairy industry is seemed as bright, although increasingly most of people around the world are meet their nutritional requirements without consumption dairy products [6]. However, as other agricultural and food industries, dairy industry has also been faced with some important environmental pressures in aspect of land, energy source and water using to provide sustainable production for consumers [7]. Some estimations and projections could be available about future production amount of milk and dairy products. For example, production of milk and dairy products is expected to expand by 1.4% per year in 2000 to 2030, up from 1.1% per year in the 1990's [5]. According to projection done by Alexandratos and Bruinsma [8] milk production is expected to increase 82% compared with 2000. Changes in trade policies have facilitated the rising availability and consumption of dairy products and processed foods [9]. These policies are expected to widen and used more commonly for all food items around the world in the future. In this study, such topics were discussed as how dairy and milk industry will evolve for the future, in aspect of both product and technology based developments. Also, the recent trends in dairy market were discussed.

Today's some important trends for dairy industry

Some important recent trends for dairy products industry are given below [10, 11]:

1. Dairy products are seemed as promising for prevention of metabolic syndrome and diabetes,

2. Fat present in dairy products may not be a reason for a heart disease risk, any more. It is because recent studies expressed that saturated fatty acids have no or positive effects on health of heart,

3. Demand for protein of milk products is supposed to increase,

4. Difficulties for consumption of milk is expected to continue because beyond the price some other important concerns that involve the environment, animal care, GMOs and diet claims are present for today's dairy industry,

5. The removal of milk quotas is affecting the industry hugely and it is vital to decide how to react to this huge change in the market,

6. Cheese and yoghurt are the two dairy products that have experienced the highest growth. Both are mostly purchased for snacking purposes, cheese due to its versatility and yoghurt due to its healthier profile,

7. The European dairy market is set to increase its demand for more innovative and health related dairy products – these are a great source of protein and calcium but healthier and lower fat choices are being highly demanded by the industry, with a large percentage of consumers considering healthy attributes when buying,

8. Women tend to consume a higher amount of dairy products in comparison to men,

9. Protein drinks are starting to be purchased not only by people who practice sport, but by a wider range of consumers.

The future of probiotic dairy industry

The quick and effectual increase in the sales of probiotic products around the World has come from establishment of enterprises containing dairy products carried out by Yakult, Danone and Valio in the past twenty years [12]. Meaning of probiotic is "for life" [13]. Probiotics are alive micro-organisms and if they consumed in sufficient amounts, they provide some health benefits on the host [14]. They are grouped into functional foods in general. Market for functional foods are increased day by day since the

increasing cost of healthcare, the steady increase of life expectancy, and the desire of older people for improved quality of their later years and more. For these reasons, the development of functional foods, especially probiotics, appears to be a long-term trend with important market potential [15] and has a bright and promising future [13]. Functional foods have been growing by nearly 28% per year. Consumers are desired to pay a premium price for enriched products is also a key driver for innovation [16]. For future of functional food markets, it is expected that new type of products and novel production technologies about them are to be key research and development area [17].

The expected research trends in probiotics both in aspect of scientific and technological to be like followings [17]:

i) To research the mechanisms of action of probiotics in the gastrointestinal (GI) tract, and develop diagnostic tools and biomarkers for their assessment.

ii) To investigate the effects of probiotics on GI-diseases, GI-infections, and allergies.

iii) To provide survival of probiotic products with developing and using feasible technologies such as development of both process and material for microencapsulation

iv) To develop technology for non-dairy, novel or artificial probiotic applications.

v) To assess probiotics' role among healthy consumer groups and to define aspects of consumer.

Currently, one of the most important research trends in functional foods is designing of personalized functional foods. This may be possible in the next years with aid of nutrigenomics [15].

There is a promising area for prebiotics to control weight of people (e.g. management for loss of weight or gain of weight) by targeting particular gut microbes is worthy of investigation [12]. A recent human study carried out by Goodrich, J.K., et al. [18] suggested that the genetic make-up of an individual can support bacteria, such as *Christensenellaceae*, and thereby promote a lean figure. This may able to reduce obesity by altering metabolism [12]. Moreover, Non-alcoholic fatty liver disease (NAFLD) is associated with obesity. A recent study suggested that children already suffering from NAFLD might be aided by 8 strain probiotic VSL#3 intake [12]. Another important area for dairy probiotics that has great potential is in detoxification of environmental pollutants from body of human and animals by lactic acid bacteria [12].

Dairy has a promising chance for more advance. For example, it may find new ways to manage weight of people for more healthier preferences [19]. In Figure 1, it was shown that healthier dairy products became an important trend by time with various types of products.

Genetic engineering applications for dairy industry and its future

Progresses in the technology of recombinant DNA have ensured the chance either to alter the milk composition or to obtain completely new proteins in milk. The progress in livestock growth or survivability via the modification of milk content needs production of transgenic animals that (i) produce a higher amount of milk; (ii) produce more nutritious milk; or (iii) produce milk that has beneficial "nutriceutical" protein [20] to improve health.

Genetically modified microorganisms and innovative technological possibilities may create novel fermented dairy products. The enriched and fermented products is estimated to be very commonly consumed in the near future [13]. Recently, human lysozyme was produced in the milk of genetically modified goats to increase efficiency of cheese-making. By this way it is possible to reduce rennet clotting time and increase curd strength, leading to faster cheese making and firmer cheese [2]. In addition, casein concentration enhancement of milk will have decreased the required time for rennet coagulation and whey expulsion. This is able to provide firmer curds that are crucial for making of cheese. The deletion of phosphate groups from casein will have resulted in softer cheeses [20].

It could be far away for now, but in the near term there will be other novel developments for dairy industry. For example, in the future, with molecular biology technique, it is possible to alter animal genomes to obtain different kind of milk products to meet different and various demands of consumers like as milk including low atherogenic compounds (casein, cholesterol, short-chain fatty acid, trans-isomers fatty acid), antibacterial properties, high anticancerogenic fats (polyunsaturated fatty acids, sfingomielin, butiric acids and lipid ethers), and milks with a composition similar to human milk [21].

How dairy industry will have been affected by nanotechnology, future prospects

Nano–science and –technology is a promising area related with nearly all areas as well as dairy science and technology. For example, nanosieves are able to use to filter of milk for production of cheese. Nanofiber of microbial

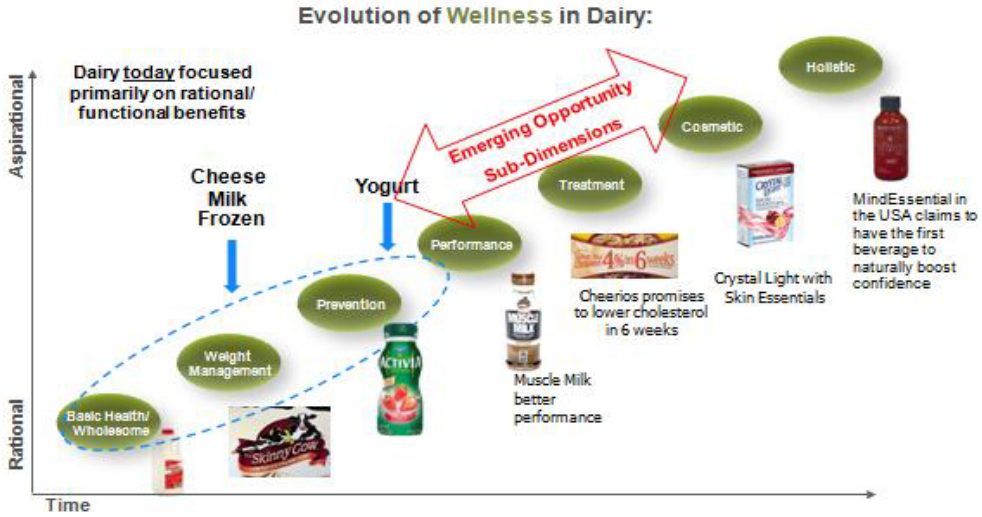

Figure 1. Evolution of wellness in dairy industry [19]

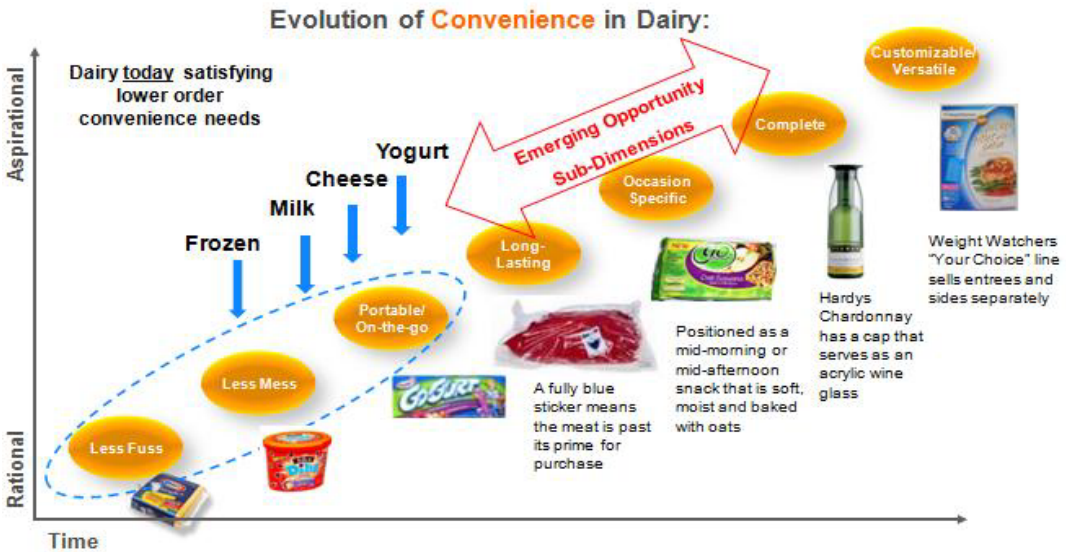

Figure 2. Evolution of convenience in dairy [19]

cellulose produced by fermentation was also studied to develop novel nanostructured materials [22]. In addition, a company, Snow Brand Milk Produce Co. (iron-whey nanoparticulates), was studied about nano-milk products [23].

Packaging materials or filters that are produced by using nano-science and technology are able to have self-cleaning properties that remove all harmful bacteria found in milk or water with out boiling. In the area of nanolaminated coatings on the bioavailability of encapsulated lipids, bioactive lipophilic or fat-liking compounds may be incorporated into foods or beverages, which may increase the ingredient's stability, palatability, desirability and bioactivity [22]. Nanotechnology is also useful for dairy products industry by supplying different type of products. For example, nanomilk that have similar taste with cola was developed by aid of the nanotechnology from Wageningen University in Holland [22].

Today and future developments for dairy industry based on products

Dairy foods that has lower sodium content milk, lactose-hydrolysed milk and lower fat content milk have been produced to meet special demands of people. Other dairy products, like as ultra-pasteurized and cultured dairy foods, have been introduced in response to consumer demands for increased length of storage and variety [3].

It is expected that the main and traditional dairy industry products such as liquid and concentrated milk, milk powders, milk protein ingredients, milk fat products such as cream, butter and butter blends are also available and remain into the future. However, these products may have more specialized sub-products such as regional cheeses as in today but more different kinds and numbers. The production of higher value nutritional and bioactive ingredients, including whey protein isolate, milk protein concentrate powders, lactoferrin, bioactive peptides, whey phospholipids, colostrum, glycolipids and oligosaccharides, might be expected to increase [7]. On the other hand, it was noticed that dewatering milk saves transport and refrigeration costs. Concentration on-farm can contribute to improving the environmental sustainability of the dairy industry by reducing transport and refrigeration costs and emissions [7]. This may also aid in manufacturing processes [24]. For this reason, in the near future, some applications

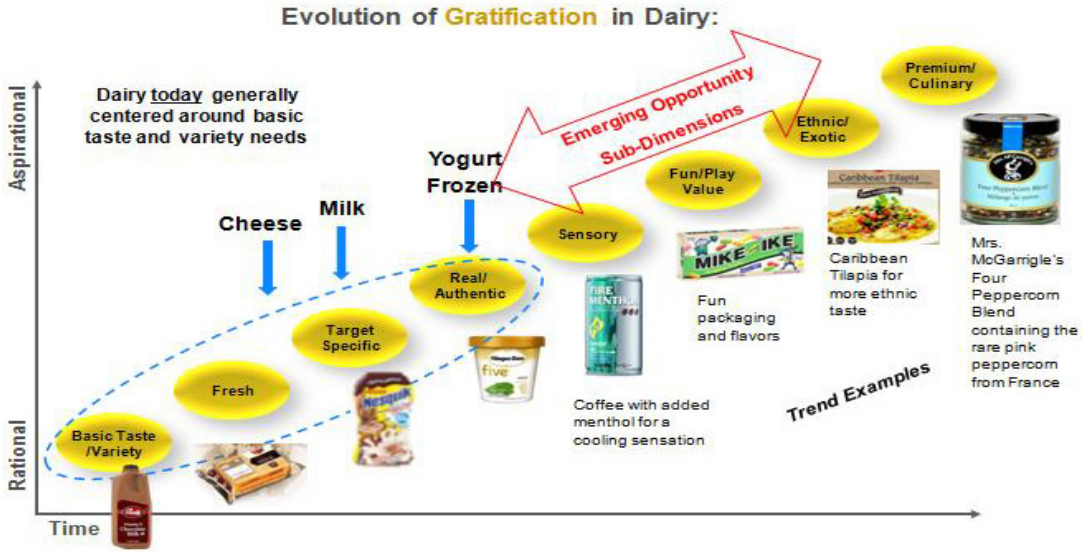

Figure 3. Evolution of gratification in dairy [19]

Table 1. Projections of average rate of growth per year for production and consumption of milk and dairy industry products to 2030 and 2050 [29]

	Production			Consumption		
	1981-2001	1999/01-2030	2030-2050	1981-2001	1999/01-2030	2030-2050
	Annual growth – per cent					
Developing countries	3.7	2.5	1.4	3.4	2.5	1.3
-East Asia	6.4	3.0	0.6	5.5	2.7	0.7
-Latin America and Caribbean	2.9	1.9	1.0	2.7	1.8	0.9
-Near East and Nort Africa	2.4	2.3	1.5	1.6	2.3	1.5
-South Asia	4.6	2.8	1.5	4.5	2.8	1.5
-Sub-Saharan Africa	2.2	2.6	2.1	1.5	2.6	2.0
Former centrally planned economies	-2.1	0.1	-0.2	-2.3	0.1	-0.2
Other developed countries	0.3	0.5	0.2	0.3	0.4	0.2
World	**0.8**	**1.4**	**0.9**	**0.8**	**1.4**	**0.9**
World excluding former centrally planned economies	1.7	1.7	0.9	1.7	1.7	1.0

may available on this.

Differently sized milk fat globules have different polar lipid and fatty acid compositions, and for this reason there is potential to choose small sized milk fat globules for specific health enhancing features [7]. If this application will have applied, consumers may have some products based on small sized milk fat globules that suitable for their specific health or nutrient problems in the near future.

Portability is being more important for convenience aspect of milk industry. There is also chance to deliver on more appetising convenience requirements within dairy-including longer-lasting, occasion-specific, complete and customization-as well as further support for "on the go." [19]. In Figure 2, it is illustrated that products may ease life of people were selected more today than past by people.

In addition, dairy has a promising chance progress for fresher, more authentic products and food needs [19]. In Figure 3, importance of satisfactory and its impacts on dairy products are illustrated. As shown in Figure 3, satisfactory is not related with only taste or aroma of the products, it was also related with supplying different expectations of the consumers such as fun/play value or freshness of the products etc.

Today and future developments for dairy industry based on technology

Some of the products and production processes in the dairy industry is expected to remain same but addition of new processes and products are possible in the future. These new production lines may provide using of less energy to produce products as a response to increased environmental pressures. Moreover, more stringent demands by consumers on processes and products, including traceability of the milk supply are economic and possible with new type of production lines and dairy factories [7]. The vision of dairy production industry for the future is one, which aims to integrate novel approaches to obtain long-term revenue. These include process interventions such as decreasing of carbon emissions or improving efficiencies and also some aims like as initiatives are able to produce nearly zero wastes and the realisation of waterless factories [7]. Technologies that are emerging day by day for food processing have more potential to be used in dairy factory of the future [7].

Innovative and new emerging technologies such as high-pressure processing, high-pressure homogenisation, enzymatic crosslinking by transglutaminase, ultrasonic processing, simultaneous emulsification and mixing novel applications for fractionation processes or new separation processes such as chromatographic and membrane separation methods, pulsed electric field and cool plasma technologies, their potential usage and applications with expected results on dairy industry (such as effects on processing time, product traceability, more sustainable production line and more effective process lines etc.) and products (organoleptic, textural, aromatic etc. properties of products) were explained by Augustin, Udabage [7], [25, 26].

Future dairy factory is estimated to contains many important traditional processes that are presently used in the manufacturing of dairy products (e.g., heating, homogenisation, concentration and drying) with improved efficiencies [7].

It is envisioned that the industry has to move beyond the traditional dairy factory boundary to whole-of-supply-chain assessments (Figure 4). Reducing wastes of the dairy industry as soon as possibly much less amount is expected to be first task for sustainable dairy production practices in the next year from farm to the fork including all the steps required to produce dairy products. Processing on-farm may also be considered as a means of minimising waste, water and energy [7]. In Figure 4, the dairy factory of the future is shown.

Even though there is need to explore more about electronic noses, they have potential for applying process controls, raw materials quality controls, first and final products quality controls, assistance in the development of new products, as well as to the assessment of synergistic effects of individual odorants [27]. Applications of electronic nose to the dairy industry have various examples such as, ageing of milk and shelf-life prediction, classification of off-flavours in milk, classification of bacteria cultures in milk, classification by the cheese variety, detection of "rind-taste" in Swiss Emmental cheese, classification by the geographical origin of a dairy product, classification of cheese by the ripening stage [27]. Another key feature that will have been probably important in the future is the traceability of dairy products [7]. With development of sensor technology such as Radio-frequency identification (RFID) and internet technology, traceability applications for dairy and other food industries will have been more common.

Consumption and economic trends in dairy industry for today and future

Between 1981-2005, the price of milk is changed between US$10/ton or and US$25/ton around the World. However, in 2007, globally, the price was increased rapidly

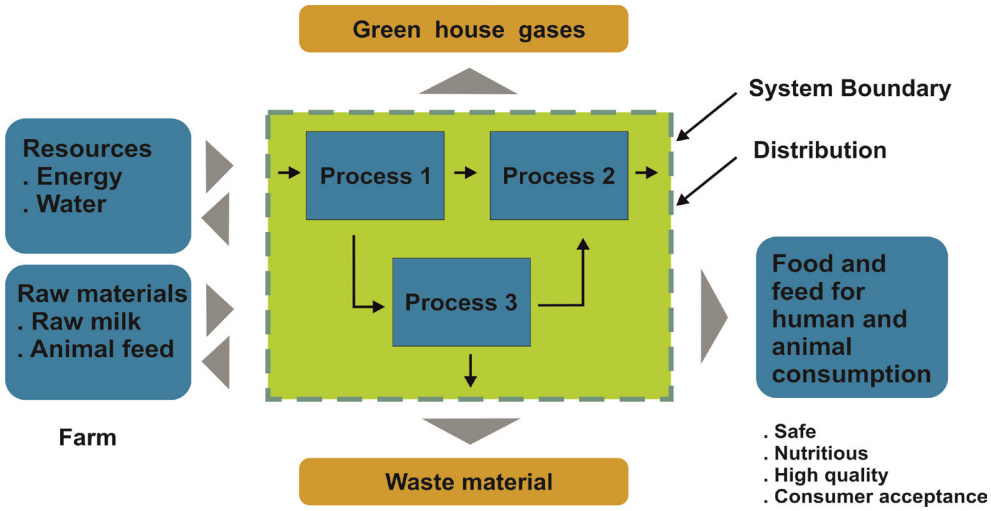

Figure 4. The estimated design for a dairy factory in the future(In the next times, it is possible to be an expansion of the traditional boundary of a dairy factory (dashed lines). In the next years, it is projected to construct more effective production facilities by reducing amount of wastages, water and energy use[7])

by 75% to more than US$45/ton[28]. EU–25 and South Asia countries are the major milk production regions accounting for 44 per cent of milk production around the world. In the period 2002 to 2007, world milk production grew by 13%, majority of this increasing is due to production increases in China, India and Pakistan. All, for this reason, shares of developing countries for dairy production systems have increased in global milk production [28].

Even though it may be slowing down a bit, production and consumption of dairy products are estimated to stay strong [29]. Milk output is expected to almost double from 580 million tons in 1999–2001 to 1043 million tons in 2050 [30]. According to Kearney [9], it is not expected to be a significant changes in butter and cheese consumption globally.

Milk is expected to be one of the most volatile agrarian commodities in the next decades. The reasons behind this are: (i) the strong effect that small changes in the quantities available internationally have on world market prices; (ii) the length of time before there are increases in milk production as a result of price changes; and (iii) postponed reaction of the demand for altering prices of dairy commodity [28]. For these reasons, future world milk prices may well range betweenUS$15 and US$50/100 kg milk [28]. In Table 1, the changes in production and consumption amount of milk are shown for different decades from 1981 to 2050.

Conclusion

Dairy is a big and important industry for today's World. There are many components that affect its today and future. These are basically consumer demands or production trends, technological developments, political decisions, global warming and sustainability. Actually, all of them should be carried out in different studies and comprehensively. For this reason, in this study just for two aspects future of dairy industry were investigated. One of them is technological developments and the other one consumer demands or production trends. According to this study, technology is expected to develop for dairy industry especially protecting nutrious components of the dairy products. Also, technology is expected to evolve consumer demands and expectations. For instance, more various type and personalised products may available in the future. This has some reasons such as increasing population of older people around the World. These people have different expectations such as special health benefits products. For this reason, in the future older people-oriented market for dairy products may available with considerable value. On the other hand, nano-technology may provide unique opportunities for the dairy industry from farm to fork, that is, for whole production cycle of the dairy products. For example, component scavenger packaging application depend on requirement of the product may extend shelf-life of the product and conserve sensory properties of the products which are desirable properties for consumers. Beyond the all, nanotechnology and other scientific disciplines may revolutionize whole dairy industry from way it produce to consumption. For instance, in the far future, milk may be synthesized atomically and based on specifically personalized for consumer demands. As another option, milk may synthesized in the laboratories that meat was done. On the other hand, more developed packaging applications such as Radio Frequency Identification Systems (RFID) may provide information about history of the product and this may ease traceability of the product by consumer. By this way, consumer have idea on origin of the product then may calculate carbon-footprint of the foods if they are sensitive and select the product by aware of the whole required things.

Probiotic or prebiotic products may able to categorize different class from other dairy products because of its functional properties, huge market value and potential. It is expected that functional dairy products industry is growing more by time to meet different consumer demands especially for their health-related benefits.

Industrial production of dairy products is expected to be more environment friendly and sustainable. For this reason, waste management of the factories is projected to be more important in the next decades. Also, in the next decades some brands may have an important market value beyond their product quality or other properties due to their sustainable production methods. For example, by aid of nanotechnology more energy-efficient solar panels may available and some brands may use these to obtain energy for their production sites. Surely, sustainability of the dairy industry is not only depend on utilized technology for it, it is also about treatments to obtain raw materials e.g. growing methods of animals to produce milk that is sources for most of dairy products. All these are complex and should be considered

separately in another study.

As a conclusion, the future of dairy industry is depending on consumers' opinions. It is because if consumers are not accept the application, the application is not apply in the industry after a time. Consumers have many expectations but basically they are expected to wholly sustainable (not only for people health, environment or production methods but also including animal welfare) industrial application and also meet their demands (for not only in aspect of health benefits but also different type of demands such as improved taste of product etc.). For this reason, company or products that will have won battle in the future for dairy industry is probably close these demands or expectations.

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