Review

Value Addition and Coconut-based Beverages. Current Perspectives

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Review

Value Addition and Coconut-Based Beverages. Current Perspectives

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Abstract: (1) Background: The definition of value addition is based on the process or processes which are used to transform physically the initial raw material in the final food or non-food article. Diversification can enhance the possibility of increased gains. The aim of this work is to give a reliable description of value addition when speaking of coconut-based beverages among all possible derivatives; (2) Methods: a systematic review of main papers on the argument has been critically examined and discussed; (3) Results: Processing degree is a consequence of consumers' requests. Three different drivers for value addition have been considered: packaging, durability, and size options; sensorial features; and sustainability. Results of this investigation have highlighted the added value of several products because of recyclable packaging materials, intermediate or long durability expectations, different available sizes, and good or excellent sensorial performances; (4) Conclusions: There are different value-added coconut-based beverages with interesting perspectives. On the other side, sustainability and eco-friendly policies may be a problem for those products which are produced similarly to non-coconut based beverages. The opportunity of certified organic and/or fair-trade products could help the industry of coconuts in the next future. More research is still needed in this ambit.

Keywords: brand; coconut cream; coconut sap; coconut yoghurt; coconut water; durability; packaging; sustainability; value addition

1. An Introduction to the Problem of Value Addition

The world of foods and beverages today offers different challenges with reference to economic and technological aspects of commercial competition worldwide. One of the basic problems for primary producers of raw materials, manufacturers, distributors, and – in the broad sense of the term – the whole food supply chain, is certainly the increase of economic gain from the original raw material to the final product [1–4]. This explanation is too simplified be-cause one specific raw material can be used to obtain different types of final edible products. In addition, the realization of feeding materials and non-food applications has to be noted [5–8]. Anyway, the discussion of value addition should be explained by a theoretical viewpoint before considering specific examples.

The definition of value addition – the economic gain which could be obtained when a specific raw material is turned into a new product with increased value from the economic viewpoint – is based on the process or processes which are used to transform physically the initial raw material in the final food or non-food article. Another remarkable – and implicit – feature of value addition is the diversification of products from one single source. By a general viewpoint, it could be affirmed that the higher the number of possible products from one single raw material, the higher the possibility of increased gains (if compared with other raw materials potentially able to give only a restricted number of options) [2,3].

The geographical position of marketing opportunities – supermarkets, different mass retailers, on-line commerce, etc. – has a remarkable influence on value addition processes and related revenues. In other words, price differences may be evident enough in the same Country, region, or

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urban area – market by market – influencing also the difference between the final price for the consumer and the sum of total expenses needed to obtain the final product (including taxes) [2].

Another important and notable feature of the problem of value addition in the market of foods and beverages (with the exclusion of feeding materials and non-food products) is linked to the coexistence of different factors which may be sometimes connected to processing options [2,8,9]:

(a) Packaging options. The higher of different packaging opportunities, the higher the diversification of the same food product;

(b) Durability options. The higher the shelf-life value of a specific product in comparison with similar competitors, the higher the presumable increase of requested prices. However, the augment of durability performances may be generally linked with the number of specific processes and additions to the raw material. After all, the First Parisi's Law of Food Degradation states clearly that foods are destined to be modified during time without exceptions, meaning that (1) may articles will evolve in a non-favorable way when speaking of food consumption, and (2) long-durability foods will be modified after a specific time period and turned into a new type of food product which should be reasonably different from the designed version. In other terms, alteration or degradation is unstoppable, meaning that a certain price influence can be ascribed to shelf-life performances. Moreover, the Second Parisi's Law of Food Degradation states that the portioning of a specific commodity without adequate preservation treatments always reduce durability performances if compared with the primary commodity. Once more, the weight of processing on durability and value addition should be seen also by this specific viewpoint;

(c) Product weight. The higher the number of different weight options for the same final product, the higher the penetration in a composite market where consumers have many behaviors;

(d) Product brand. The importance of brand loyalty is not specifically linked to processes. However, with specific reference to value addition, it has been reported that brand equity can influence economic profits, consumeristic loyalty, premium price policies, advertising strategies, and distribution options;

(e) Sensorial features;

(f) Other factors not directly related to products, production processes, and so on, including the geographical position of markets, regulatory restrictions, advertisement strategies, consumeristic perception of quality/price ratios (in terms of supposed quality performances), beliefs, religions, different norms, etc.

With specific reference to coconut-based beverages, several works have discussed specifically current options and future possibilities. However, the evolution of food markets imposes to re-evaluate the situation in general and in detail also with reference to this specific ambit. The aim of this paper is to examine the situation of coconut-based beverages, including also different products which can be able to detract the amount of marketable beverages in favor of other market channels (and related consumers).

2. Coconut-based Beverages and Other Products

Coconut (*Cocos nucifera*) is extensively collected in many tropical Countries (the estimated collection is very close to 60 million tonnes of nuts per year, concerning a total surface of 12 million hectares). The use of coconuts is extremely developed in India (the third producer Country, after Indonesia and Philippines): in particular, it has been reported that approximately half of the domestic production of coconuts in India is used for culinary and religion-related reasons, while 35 % is used to produce copra. The remaining amount has different uses, but the production of value-added

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products from coconuts is only 2 %, meaning that the sector can be improved. In detail, the list of obtainable products with improved value addition from coconuts is long enough, including four main products and related derivatives [10]:

(1) Fresh coconut
(2) Coconut water
(3) Dried coconut (copra)
(4) Coconut sap.

By the viewpoint of food technologists, each of these products can act as basic raw material for new products.

Basically, fresh coconut is important 'as it is' and it can give a peculiar sterile liquid, coconut water, with interesting applications concerning food industry, health and medicine, because of its nutritional profile (richness in vitamins, minerals, sugars, and amino acids)[11–13]. It has to be considered that the commerce and export of fresh coconuts has greatly increased recently while milling copra for oil production has decreased its commercial appeal in the past two decades. Consequently, fresh coconut is sold internationally with interesting portions for coconut milk, cream, and water.

With reference to coconut water, it can be used to produce fermented liquids (vinegar) or as additive for carbonated and non-carbonated beverages [13]; however, the preferred choices are [13,14]:

(a) Tender coconut water (directly sold into the coconut fruit, ready for drink), with reduced durability (24-36 hours from detaching)
(b) Packaged tender coconut water (the same product packed into aluminum cans and pouches, with extended durability, up to six months in refrigerated conditions)
(c) Minimally processed tender coconut water (served in coconuts where the husk has been partially removed and treated in aqueous solutions with organic acids); durability should not exceed 24 days at 5-7 °C
(d) Coconut water concentrates (durability: six to 24 months on the basis of concentration) and frozen concentrates
(e) Bottled mature coconut water
(f) Coconut water beverages (normal mature coconut water with addition of food additives).

Dried coconut (copra) has been always used as an industrial raw material for oil extraction, and particularly with reference to lauric acid (final destination: margarines and detergent formulations). In other terms, edible copra is not a value-added product in terms of commercial success [13,15]. At present, and taking into account that coconut copra is not exported such in the recent past, 50 % and more of the world coconut collection is processed to copra.

Finally, coconut sap is an interesting product: basically, it is the sweet sap obtained by cutting coconut inflorescence (mature spadix). It can be used as a natural drink, but it can be also used for different value-added products [16].

After this brief premise, the following value-added foods from above mentioned coconut products can be mentioned.

Fresh coconut can be used to obtain the following value-added products:

(1) Dried coconut (derivatives: desiccated coconut, coconut chips)
(2) Coconut milk (derivatives: coconut cream, flour, milk powder, yoghurt, jams, syrups and honey)
(3) Virgin coconut oil (derivative: coconut protein powder).

Coconut water can be used to produce [10]:

(1) Tender coconut water (derivative: snowball tender nut)
(2) Mature coconut water (derivatives: coconut water concentrate, frozen coconut water, *Nata de coco*, and coconut vinegar).

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Dried coconut (copra) is used to produce coconut oil (derivatives: coconut margarine). Finally, coconut sap can be used to produce [10]:

(1) Unfermented sap (also named *neera*): derivatives are coconut jaggery and sugar
(2) Fermented sap (also named *toppy*): the known derivative is arrack.

As a result, coconut offers a notable variety of possible value-added products. Moreover, it is considered as food and as oil seed crop. The interest in this crop is easily explainable if the nutritional profile (subdivided in terms of coconut water and kernel) is considered. In brief [10]:

(a) Coconut Water gives approximately 19 kcal per 100 grams; the aqueous amount is 95 % of the total obtainable liquid. As a result, the ratio between traditionally considered nutrients (carbohydrates/ protein/ fat matter) is approximately 18.55/ 3.6/ 1.0. Carbohydrates (3.71 grams per 100 grams of coconut water) contain a remarkable amount of sugars (70.35 % on the total carbohydrate content). A little quantity of dietary fiber (1.1 %) has to be mentioned. With reference to the nutritional profile ascribed to vitamins, vitamin C is 2.4 mg, followed by vitamin B2 (0.05 mg) and B1 (0.03 mg). With concern to main metallic elements, potassium is abundant enough (200 mg), followed by magnesium, calcium, and phosphorus (between 25 and 20 mg)
(b) Coconut kernel (the counterpart of coconut water) gives approximately 354 kcal per 100 grams; the aqueous amount is 47 % of the total obtainable liquid. Consequently, the ratio between traditionally considered nutrients (carbohydrates/ fat matter/ protein) is approximately 7.28/ 10.1/ 1.0. Fat matter (33.49 grams per 100 grams) is the most abundant fraction, while carbohydrates contain only 25.6 % of sugars if compared with water. A good quantity of dietary fiber (9 %) has to be mentioned. With reference to the nutritional profile ascribed to vitamins, vitamin C is 3.3 mg, followed by vitamin B3 (0.54 mg) and B1 (0.066 mg). With concern to main metallic elements, potassium is abundant enough (356 mg), followed by phosphorus (113 mg); magnesium and calcium are low (32 and 12 mg, respectively).

On these bases [10,17–19]:

(1) Coconut water can be proposed as a sports beverage and as rehydration liquid for suffering people;
(2) An important derivative, coconut oil, is reported able to reduce consequences from different diseases such as cardiovascular dysfunctions such as abnormal blood sucrose amount and diseases such as kidney bladder infection. The presence of monolaurin and antioxidants can be distinctive advantages from a general public health viewpoint;
(3) On the other side, some different kernel derivatives can reduce the amount of potential water-related products with concern to productivity and value addition. This problem should be carefully considered.

With exclusive concern to derivatives from fresh, desiccated coconut, and coconut sap, the following products have to be described in particular detail.

2.1. Derivatives from Fresh Coconut: Dried Coconut

Dried coconut is obtained by shredded and ground coconuts after drying at 80-90 °C (duration: 10 hours) [10]. The aim of this procedure is linked with three desirable features at least, and these points can easily explain interesting value addition.

First of all, durability is enhanced: inner moisture should be reduced up to 3 % with the aim of obtaining increased shelf-life expectations. In addition, desiccated coconuts have important advantages when speaking of easy transportation. Moreover, such a disintegrated and desiccated coconut kernel would be ready to be used in the confectionery, bakery, and snack industry. Distinctive sensorial advantages concern improved flavor, ameliorated textural properties, a dust-like appearance on certain foods (on the external surface), and – in general – the opportunity of using

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ready-to-use ground coconut instead of the fresh grated type. An interesting variation is represented by coconut desiccated chips [10,20].

2.2. Derivatives from Coconut Milk: Coconut Cream

Basically, coconut cream is obtained from coconut milk by addition of emulsifying and stabilizing agents and subsequent pasteurization and canning processes. The initial raw material, coconut milk, is naturally forced to exhibit an emulsion separating an aqueous fraction and an interesting cream portion [21]. Because of the poor stability of fat matter obtained from fresh coconuts, the concentration of the creamy phase makes sense.

Substantially, it is a coconut milk concentrate with extremely high content of lipids (20-30 %; only monoglycerides instead of trans-fatty acids), interesting flavoring properties, and enhanced durability (six months after pack opening) [14]. Cream is obtained from the white endosperm part of coconuts with filtration of coconut milk, protease treatment, and centrifugation which produces cream [13,14]. It has to be remembered cream can be also used to produce virgin coconut oil with a residual protein as by-product [14]. Interestingly, the protein fraction can be concentrated with the aim of obtaining coconut protein powder (33% of protein content, and only 3 % of fat matters). This by-product can be considered an excellent source of dietary fibers. It has also good emulsifying properties and good water retention [10]. Coconut cream is mainly destined to the industry of processed foods (cakes, puddings, ice creams) and also as a good addition for soy milk when speaking of tofu production (yields can notably be enhanced) [23]. Moreover, it can be an ingredient for the production of sweetened condensed milk [13].

In general, the use of such an ingredient can be tolerated from the nutritional and health viewpoints because of the qualitative composition of lipids, provided that the final product is not too rich in fat matters [10].

2.3. Derivatives from Coconut Milk: Coconut Flour

Coconut flour, obtained from coconut milk, is substantially a good source of dietary fibers (60% of insoluble and soluble molecules) and protein. In detail, being this product free from gluten, the use of coconut flour by food industries can be considered with favor. In particular, this flour can act as bulking agent, filling additive, and a surrogate for other flours from wheat, potatoes, and rice. For this reason, industrial bakeries, snack-food industries, and producers of extruded foods may find this surrogate interesting enough. Certainly, coconut flour has distinctive advantages when speaking of reduced carbohydrate intake, boosted energy intake, and other good effects on human health (example: regulation of insulin levels) [10,24–26].

2.4. Derivatives from Coconut Milk: Coconut Yoghurt

Coconut yoghurt is a product obtained by fermentation of coconut milk with selected lactic acid bacteria, similarly to real milk yoghurts. Because of the non-animal origin and coconut milk composition, this product is extremely useful when speaking of lactose intolerance. Interestingly, commercial solutions such as soy-coconut yoghurts are available (the composition of raw materials is approximately soymilk 50% and coconut milk 50%). Naturally, these products have a well distinctive advantage on the market be-cause of their 'vegan' nature [10,30–32].

2.5. Derivatives from Coconut Milk: Coconut Jams, Syrups, and Honey

The so-called coconut jam is obtained from the pulp of dehydrated kernels; these pulps are boiled with addition of pectins, sugar, citric acid, and different food additives and preservatives until total soluble solids arrive to 67–68 °Brix and moisture reach intermediate levels. The final bottle product has a notable durability (six months after bottle opening). Naturally, the product is sold to be consumed as it is (as a dessert, for bread spreads, etc.); however, a possible and notable application in the industry of jams may be the production of coconut/pineapple jams where the proportion between coconut pulp and pineapple pulp in the original formula is approximately 3:1 [10,14,27,28].

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Coconut syrup is a different product because of its growing importance on the export markets (in Nations where coconuts are not cultivated or present). From the technological and nutritional viewpoint, this translucent liquid is obtained by mixing homogenized coconut milk and sugar approximately in the 1:1 ratio (a reduced amount of citric acid or sodium phosphate is also required ad additives). The cooled product should reach 65-68% as total soluble solids. Interestingly, uses of coconut syrups are not limited to industrial purposes (topping agent for bakery products, general ingredient for cakes, etc.), but it can be also used as an instant drink [10].

Finally, coconut candies and honey can be discussed. The first products are not different from other candies, except for the basic ingredient: coconut milk or cream. With reference to coconut honey, it is basically a viscous, gold-colored fluid without a reduced creamy aspect and a certain loss of nut flavors if compared with normal coconut syrup. Basic ingredients are skimmed coconut milk, sugar, glucose, and sodium alginate; after heating and homogenization, the final total solids content should reach 75%. Basically, the main use is for the realization of soft drinks [10,13].

2.6. Derivatives from Dried Coconut: Coconut Margarine

Basically, coconut margarine is not different enough from traditional margarines unless for the choice of main ingredients. The reported process shows virgin coconut oil as main ingredient, mixed with stearine, β-carotene (for colorimetric purposes), some emulsifying agent and antioxidants, salt, an water. After heating process at 600 °C (duration: 10 minutes), the fluid has to be packed and cooled at 16 °C [13].

2.7. Derivatives from Coconut Sap: Coconut Jaggery, Arrack, and Sugar

Coconut jaggery is peculiar product, also named palm sugar. The main feature is the original raw material, coconut sap. A fluid called *neera* (in India) is obtained by cutting coconut inflorescence [16]. The cautious evaporation of *neera* (an excellent anti-thirst drink) can give a peculiar sweet and digestive liquid (caramelization has to be considered). Interestingly, the spontaneous fermentation of *neera* can be considered: the result is palm wine (also named *toddy* in India). This liquid requires 4-6 hours of fermentation (original sap or *neera* contains 12-17 % of total sucrose); because of the possibility of sour or acidic tastes, the maximum consumption time from collection should be 12 hours [13]. Subsequently, toddy can be distilled to obtain another peculiar liquid, arrack. This product (other possible fermented products are coconut vinegar and vodka) is an alcoholic beverage (alcohol content between 33 and 50 %). The problem with *neera* is the reduced durability (minimum reported shelf life is two days) because of the innate tendency to auto-fermentation; consequently, technological solutions are needed. Anyway, *neera* and derivatives can be really useful when speaking of the future of soft drinks [10,13].

Finally, coconut sap sugar is a concentrate material containing crystalline sugar. The production process moves from limed sap; after a two steps-carbonation and subsequent filtering, resulting fluid is evaporated to obtain approximately 75 % of sugar; the resulting syrup mass has to be concentrated and crystallized. The final sugar is separated by centrifugation . Interestingly, this coconut sap sugar can be more acceptable than refined cane sugar because of the low glycemic index [10,13].

3. Coconut-based Beverages. Basic Key-points

As above mentioned, the problem of value addition is strictly related to the following key factors:

(1) Identification of the process and/or sum of designed processes able to transform physically the initial raw material in the final food or non-food article
(2) Number of different versions of products from one source (diversification enhancement)
(3) Number and typology of sale markets or points in different ambits, on the national and the international levels (the differentiation between different marketing operators in the same Nation and in selected urbanized areas may be particularly evident and should be studied in detail).

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These factors cannot be taken into account at the same time in this paper. The problem is that the third key point (number and typology of sale markets or points in different ambits) is an extraneous ambit with reference to the activity of coconut collectors, producers, and other interested business operators without direct interests and activities on the market grounds. By the viewpoint of industrial operators, the main challenges are substantially the 1st and the 2nd key-points. In this broad ambit, it has to be considered that:

(a) The influence of processes on the final value addition is a direct effect; however, the choice of one or another process or sum of synergic processes (a production chain) mainly depends on the definition of the final product. In other words, the designer has to initially restrict the number of possible value additions to a well defined number of possibilities; after a careful examination of the remaining selected products, the designer can define and possibly develop/ameliorate the process. After all, there are several quality and safety-related risks related to the choice of continuous processing chains or sequentiated (temporally separated, no continuity) processing steps [33]. Consequently, the final idea of value-added product comes first, and the technological solution – in processing terms – is only the second step

(b) As a clear result of the above mentioned point, the diversification of value-added products from one single source – such as coconuts, in this paper – is the most important key factor to be studied. Moreover, being each possible product option linked to several specific features in terms or quality, sensorial features, packaging, shelf life (durability), and so on, the definition of a peculiar product feature able to enhance value addition is not exactly the consequence of a preliminary process choice, but the first, or one of the first reasons for the definition of a peculiar food or non-food item. As a result, product diversification depends on commercial decisions based on consumeristic perceptions [10,13,28].

On these bases, a good portion of above-mentioned products – coconut-related fluids only -will be analyzed in brief with reference to selected key points (the number and qualitative discussion of processes will not be considered, being these features defined as the effect of below-mentioned factors):

(a) Packaging, durability, and size options

(b) Sensorial features

(c) Sustainability (eco-friendly products).

A summary of the qualitative evaluation is offered in Table 1.

3.1. Packaging, Durability, and Size Options

Packaging options are discussed here, also with relation to durability (low expectations: lower than three months; intermediate results: between three and 24 months; high performance: higher than 24 month) and size options (different available choices or one size/format only). From the viewpoint of value addition, and taking into account the problems of packaging, durability, and size choices at the same time, the best opportunities can be observed with reference to the following products, as shown in Table 1 [10,13,14]:

(a) Packaged tender coconut water. Available packages are aluminum cans and coupled pouches. The choice of mentioned packages allows obtaining technological results – in terms of reproducible, speed, and safety-acceptable production processes - and also intermediate shelf-life expectation if compared with only 24-36 hours for fresh tender coconut water. Refrigerated conditions are a good option, but room temperature storage is also possible. Different size options are available. Interme

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(b) Coconut water concentrates and frozen concentrates. Available packages are plastic containers and metal cans; intermediate durability values range six to 24 months on the basis of concentration. Different size options are available
(c) Bottled mature coconut water. Glass or plastic bottles are available. Intermediate durability; different size options are available
(d) Coconut water beverages. Glass or plastic bottles are available. Intermediate durability; different size options are available
(e) Coconut cream. Sterilized tin cans are reported. Low, intermediate and long durability; different size options are available;
(f) Coconut yoghurt. Glass or plastic bottles are available. Low or intermediate durability; different size options are available
(g) Coconut jams, syrups, and honey. Glass bottles and plastic packages are available. Low or intermediate durability; different size options are available
(h) Coconut jaggery, arrack: glass bottles and plastic packages. Glass bottles and plastic packages are available. Variable durability; different size options are available

As a clear result, it appears that the main part of coconut-related beverages needs plastic coupled pouches, metallic cans, and glass containers. Shelf life expectations and the availability of different sizes are also correlated with the following points:

(1) Ameliorated aspect of the content (where possible; example: transparent containers for caramelized/brown fluids)
(2) Enhanced shelf-life expectations (non-transparent packages are generally preferred with the aim of excluding ultraviolet rays and consequent durability decay; metal cans are used at room temperature)
(3) Good sealability of packages;
(4) Good or excellent rapidity of packaging operations, especially where hot filling and other heat treatment are required, and high speed-processed are desirable.

3.2. *Sensorial Features*

From the viewpoint of value addition, and taking into account the problem of sensorial features (which should recall the original coconut nature), the following points can be highlighted, as displayed in Table 1 [10,13,14]:

(a) Tender coconut water. Excellent features as ready-to-eat drink
(b) Packaged tender coconut water. Good or excellent sensorial performance if compared with tender coconut water
(c) Minimally processed tender coconut. Similar results in comparison with tender coconut water
(d) Coconut water concentrates and frozen concentrates. Probably, sensorial features may depend on the subsequent use of these products; consequently, there is the risk of variable results. Anyway, sensorialresults should not be comparable to the original coconut water (moderate processing)
(e) Bottled mature coconut water. Good or excellent results
(f) Coconut water beverages. Good or excellent results should be expected. However, sensorial results should be different from the original coconut water (addition of other compounds)
(g) Coconut yoghurt. Good results, also if used in conjunction with other products
(h) Coconut jams, syrups, and honey. Good results, also if used in conjunction with other products
(i) Coconut jaggery, arrack: Good results are generally claimed.

As a clear result, it appears that the main part of value-added coconut-related beverages can exhibit good or excellent sensorial features if compared with the original raw materials. However, an interesting consideration concerns the 'surrogate' nature of many of these products. In fact, the 'coconut' origin is always claimed and recognized in the name of products; on the other side, the trend ap-pears to be the creation of articles which can be able to replace totally or partially non-coconut based foods. As a result, the sensorial evaluation does not appear to have direct relationship

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with coconut, while the similarity with other non-coconut based foods is implicitly claimed (example: yoghurt, alcoholic beverages, vinegar…). This factor should be taken into account when speaking of value addition.

3.3. *Sustainability (Eco-friendly Products)*

From the viewpoint of value addition, and taking into account the problem of sustainability and eco-friendly products and ser-vices, the basic definition of Sustainable Development Goals (SDG) as defined at the United Nations Conference on Sustainable Development Rio+20 (Rio de Janeiro, Brazil, 2012), should be remembered. In this ambit, 17 different SDG were defined, including [34]:

(a) 'End hunger, achieve food security and improved nutrition, and promote sustainable agriculture' (SDG No 2)
(b) 'Ensure availability and sustainable management of water and sanitation for all' (SDG No 6)
(c) 'Ensure sustainable consumption and production patterns' (SDG No 12).

On these bases, and taking into account that the supply and productive chain of coconut-based products is still rather low if compared with other food production ambits, the following aspects can be highlighted (Table 1) when speaking of sustainable/eco-friendly coconut-related products [10,13,14]:

(a) The only sustainable and eco-friendly beverages are naturally tender coconut water and minimally processed tender coconut water (absent or very limited food processing; absence of packaging materials)
(b) All processed coconut-based beverages suffer of the same limitation of other industrial foods. Probably, enhanced durability can be a good challenge because intermediate and long-durability foods are correlated with moderate or strong processing degrees, enhanced packaging materials, high-energy consuming storage systems, and broad transportation networks. The use of glass bottles and recyclable containers can be a distinctive advantage in this ambit, while plastic-based packaging materials and objects is still a recovery/recycling problem. Consequently, all remaining value-added products may have interesting margins for improvement by the sustainability viewpoint, and consequently intermediate impacts.

An important opportunity can be the option of organic and fair-trade coconut productions. At present, there is some difficulty in these ambits [35–39]. However, value addition should receive a notable enhancement in the specific sector of coconut-based beverages in future, also because there is some parallelism between these policies (the Roundtable on Sustainable Palm Oil, *www.rspo.org*, has a reputable success) and sustainable models. More efforts are needed.

4. Coconut-based Beverages and Value-added Products. Concluding Remarks

The aim of this paper has been to show the current perspectives of value addition with reference to coconut-based beverages. After a detailed discussion concerning all typologies of coconut-derived products, including solid commodities, the consideration of basic value addition-drivers for beverages has shown that qualitative differences between these products is not strictly dependent on the ex-tent of processing degree. In fact, the higher the expectation of de-signers, industries, and finally consumers when speaking of durable, processable, and palatable foods, the higher the number of different processing and preservation treatments. Consequently, processing degree is a consequence of the consumeristic request. As a result, our investigation has mainly taken into account three different value addition drivers which can be directly managed by coconut harvesters, producers, and so on: packaging, durability, and size options; sensorial features; and sustainability (eco-friendly products). Results of this investigation have highlighted the notable added value of several products - packaged tender coconut water; coconut water concentrates and frozen concentrates; bottled mature coconut water; coconut water beverages; coconut cream; coconut yoghurt; coconut jams, syrups, and honey; coconut jaggery, arrack – because of recyclable packaging materials (even if recovery and recycling are still a big challenge when speaking of plastic packages), intermediate or long durability expectations, different available sizes, and good or excellent sensorial

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performances. Sustainability and eco-friendly policies may be a problem for those products which are produced similarly to non-coconut based beverages (and the trend in favor of extensive research for surrogates of the food industry has been noted), but the opportunity of certified organic and/or fair-trade products could help the industry of coconuts in the next future, similarly to successes in similar ambits. Anyway, more research is still needed when speaking of value addition for coconut-based beverages.

Table 2. A qualitative evaluation of coconut-based beverages as value-added products

Original coconut raw material	Value-added products	Packaging, Durability, and Size Options *	Sensorial Features *	Sustainability (Eco-friendly Products) *
Coconut Water	Tender coconut water		++	++
Coconut Water	Minimally processed tender coconut		++	++
Coconut Water	Packaged tender coconut water	+	++	+
Coconut Water	Coconut water concentrates and frozen concentrates	+	+	+
Coconut Water	Bottled mature coconut water	+	+	+
Coconut Water	Coconut water beverages		+	
Coconut Milk	Coconut cream	++		+
Coconut Milk	Coconut yoghurt	+	+	+
Coconut Milk	Coconut jams, syrups, and honey	+	+	+
Coconut Sap	Coconut jaggery, arrack	+	+	+

* The "++" symbols mains "good or excellent result"; the "+" symbol" is for "intermediate or low/variable" results.

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