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Promoting sustainable food consumption: the case of nutrition education programs in public schools

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Summary

Within the realm of public policies for a sustainable food system, the focus has gradually shifted from production oriented towards consumption oriented interventions. Whilst changing consumer behavior can have a long-lasting positive environmental impact, choosing effective sustainable consumption policy instruments may be a challenging task. In the case of food consumption, the choice of interventions is particularly difficult because of the multiple aspects- psychological, cultural, economic, religious- associated with eating habits.

The paper deals with one of the most commonly used forms of intervention, nutrition education programs in public schools. The main conclusion of the paper is that a major effort should be made by the Ministry of Education, school managers and educators, in the field of food education intervention. Food education activities should be able not only to encourage better food habits but also to involve children in all aspects of the food system, with the aim of promoting the emergence of a new culture of sustainability, sovereignty and food security. Moreover, a further research effort is required in order to understand the influence of psychological and socio-demographic variables on children's food habits, so as to provide policy makers with information which is of practical use when choosing the best strategies and tools for intervention.

Keywords: *sustainable consumption, nutrition education, welfare economics, food governance*

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1. INTRODUCTION

Within the realm of public policies for a sustainable food system, the focus has gradually shifted from production oriented towards consumption oriented interventions. The definition of sustainable consumption refers not only to the environmental dimension, but also to the economic, social and health dimensions. The most frequently used set of sustainable food indicators includes: meat consumption, food waste, food miles, local and seasonal food consumption, healthy diet, preference for fair trade and organic products, animal welfare concerns.

Whilst changing consumer behavior can have a long-lasting positive environmental impact, choosing effective sustainable consumption policy instruments may be a challenging task. Whatever instrument is chosen (from among the different regulatory, economic, communication-based and procedural-voluntary instruments), its implementation requires the effort and coordination of numerous societal domains and actors and may raise controversial debates, for instance on the paternalistic role of the state or on the consumer's freedom of choice. In the case of food consumption, the choice of interventions is particularly difficult because of the multiple aspects- psychological, cultural, economic, religious- associated with eating habits.

The paper deals with one of the most commonly used forms of intervention, nutrition education programs in public schools. These programs aim at providing children with knowledge of diet, health and environment in such a way as to promote children's healthy and environment-friendly eating habits. The paper presents a case study from the municipality of Naples. Drawing on the results of a survey recently carried out at the University Federico II of Naples, the case study investigates children's dietary habits in order to assess the role that nutritional education in schools may have for the promotion of sustainable food consumption.

The paper is organized into three sections.

The first section reviews the concept of sustainable consumption, and critically assesses government policies towards the intervention effectiveness and the consistency with ethical principles endorsed by politicians and society at large. It is shown how different goals and instruments may be supported by different social welfare theories. Emphasis is placed on criticism made by behavioral and ecological economics as to the inability of neoclassical welfare economics to deal with endogenous preferences and deontological moral theories

The second section deals with policies aimed at promoting sustainable food consumption, placing the analysis of such policies in the broader context of "food governance" issues. Particular attention is paid to the definition of sustainable diet and to the policies, including education programs in schools, useful in promoting sustainable eating habits.

The third section presents the results of a survey on the level of sustainability of children's food habits in the municipality of Naples, with the main purpose of evaluating the impact of school nutrition education policies. Children's food habits and school education programs are assessed against dietary and nutrition education guidelines provided at national, European and international level.

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2. SUSTAINABLE CONSUMPTION: A CONTROVERSIAL CONCEPT

Following the success of the concepts of sustainability and sustainable development, launched in 1987 by the Brundtland Commission of the United Nations, the goal of sustainable consumption entered the political agenda of intergovernmental organizations (IGOs) in 1992 in the course of the United Nations Conference on Environment and Development (UNCED). In 1994, the Oslo Symposium proposed a working definition of sustainable consumption as "the use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations". Since then, many IGOs have addressed the issue of sustainable consumption, providing guidelines for public intervention and supporting various activities and campaigns (OECD, 2008). Particularly noticeable has been the engagement of the United Nations Commission on sustainable Development (CSD), the United Nations Environmental Programme (UNEP) and the Organization for Economic Cooperation and Development (OECD). In the European Union, the topic has recently attracted renewed interest with the work of The European Environmental agency and the European Topic Centre on Sustainable Consumption and Production.

The common vision which has been developed by scholars from different disciplines and the various IGOs throughout their research and political work is that, in order to promote sustainable consumption, successful actions/interventions need to provide leverage on three points: an ecological awareness and a new lifestyle attitude on the part of consumers; a new business ethic able to combine economic incentives and social responsibility with win-win strategic business conducts; an effective public intervention, able to build an information and institutional framework which might push both firms and consumers towards sustainable choices and behaviors. While consumers seem to be the central players responsible for moving towards sustainable consumption paths, in effect this might not be the case. Consumer behavior depends on a wide array of internal and external stimuli and constraints rooted in given cultural, institutional, technological and economic environments, which are largely shaped by actions carried out by firms and governments. Firms may foster sustainable consumption in many ways: designing eco-efficient and environmentally friendly products; influencing consumer behavior through advertising and eco-labelling; observing ethical codes of conduct; engaging in corporate reporting; and so on. Policies on the part of public actors may include; market based instruments, such as taxes and subsidies; standards and mandatory labels; communication policies; education.

At an academic level, the issue of sustainable consumption has been addressed in the research fields of ecological economics, industrial ecology, and behavioral economics. Different aspects of sustainable consumption have been investigated, such as: the evaluation of consumption environmental impact, through models of input-output life cycle assessment and carbon footprint measures; the design of production-consumption eco-efficient solutions; the study of behavioral determinants of green and ethical consumerism.

Despite increased public awareness of the topic, the strong commitment of governments and businesses, the various declarations and guidelines produced by IGOs and the great research effort by scholars of different disciplines, no progress has been made in the direction of more sustainable consumption patterns over the last twenty years. As early as in 2005, Fuchs and Lorek (2005) entitled their survey of the work of IGOs in the field of sustainable consumption "Sustainable consumption governance: a history of promises and failures", pointing the finger at the ineffectiveness of action taken until then. More recently, a large number of published papers have clarified the causes of such a failure. As recognised by Thogersen and Schrader (2012), over the last three years various journals have published special issues analyzing the causes of the scant progress in the field of sustainable consumption. It is worth mentioning here, among others: in 2010, the special issues published by the Journal of Industrial Ecology (January/February, edited by Tukker et al.), the Natural Resources Forum (February, edited by David le Blanc), the Journal of Consumer Behavior (November/December, edited by Iain Black), and the Journal of Macromarketing (June, edited by William Kilbourne); in 2011 and in 2012 the two special issues by the Journal of Consumer Policy (March, edited by John Thøgersen and Ulf Schrader).

To date, many explanations have been given as to why consumption patterns in modern society are still far from being sustainable. While a complete survey of the literature is beyond the scope of this paper, it is possible to quote at least four arguments, which are particularly important for the analysis of food consumption policies: the rebound effect; the Knowledge-to-action gap; the Behavior-impact-gap (BIG) problem; the "double dividend", i.e. the opposition between weak and strong sustainable consumption.

The rebound effect refers to a behavioral or other systemic response to a measure taken to reduce environmental impacts that offsets the effect of the measure (Hertwich, 2005). The typical example is the

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case of energy-saving devices which, while reducing the marginal cost of energy, determine an increase in the demand for services such as heating, lighting or transportation. Moreover, the economic growth promoted by energy-efficiency may entail a further increase in energy demand. Likewise, consequence efficient devices may lead to a net increase in energy use (Greening at al., 2000).

When designing consumer policies, it is generally taken for granted that the greater the information consumers have on the environmental impact of their current consumptions and on "green" alternatives, the more they will switch to sustainable consumption. Instead, it has been documented that this is often not the case. A knowledge-to-action gap exists to such a point that the knowledge and the awareness of environmental problems may not be sufficient to change consumer behavior and lifestyles. This gap depends mainly on three factors. Firstly, there may not be adequate sustainable consumption options; these might be unattractive, due to dominant tastes and social norms, too expensive, or requiring a high "purchasing effort" (i.e. hard to reach). Secondly, consumers might not be adequately motivated to change their habits. Consumption decisions are influenced by a multitude of values and criteria competing with environmental and social values, and sustainability may rank low compared to competing aims. Consumption is strongly influenced by socio-economic conditions, leading to a conflict between personal values and social expectation (Gastersleben et al, 2002). Furthermore, business communication strategies often confuse consumers, soliciting purchasing motivations which contrast with sustainability. Thirdly, the knowledge-to-action gap may be due to the discursive confusion faced by consumers when striving for more sustainable consumption practices (Markkula, Moisander, 2012). When the informative and socio-cultural frameworks become too complex and imbued with contrasting opinions and value judgments, consumers tend to stick to dominant habits, unable to make radical changes.

The Behavior-impact-gap (BIG) is confronted whenever the required behavioral change is achieved, but the observed ecological effect is minor or missing. In other words: "even when the required behavior changes do happen, the results may lag far behind what was originally expected; inconsistencies can be found between the behavior of consumers and the outcomes observed" (Csutora, 2012). The gap can be due to: a miscalculation of the effective reduction in ecological footprint resulting from pro-environmental behaviors; effects similar to the rebound effects; negative ecological spillovers and external interferences (behaviors of other people and system structural adaptation).

The fourth argument explaining the failure of sustainable consumption policies points to the problem of the scale rather than the kind/quality of consumption. Scholars endorsing this argument suggest that a kind of "double dividend" is inherent in sustainable consumption: the ability to live better by consuming less while reducing the impact on the environment of whole consumption activities (Jackson, 2005). Accordingly, what is needed is a strong sustainable consumption perspective (Fuchs, Lorek, 2005), questioning the level of material consumption as a meaningful measure of well-being and calling for a radical change in levels and quality of consumption. The weak sustainable consumption approach instead, endorsed by policy makers and environmentalists so far, focuses on eco-efficiency and product "green innovation" assuming a business as usual and a continuous economic growth scenario.

The identification of the causes that have led to the failure of the efforts made so far to promote sustainable consumption helps to delineate some important tenets upon which a better future consumption sustainability governance should be based. As shown in table 1, what we have learnt is that to promote a real change we have to acknowledge that: 1) traditional consumer theory (and the myths of rational economic actor and consumer sovereignty), used so far for policy design, does not fit real world and is inconsistent with effective sustainability policies; 2) market-based instruments perform poorly compared with command-and-control instruments; 3) sustainability goals require a strong cultural change based, inter alia, on ethical principles overcoming the limits of utilitarianism.

It is a matter of fact that the current un-sustainable patterns of consumption are supported and legitimised by the neo-classical consumer theory, which assumes selfish maximizing consumers with unlimited wants and exogenous preferences. An important outcome of these assumptions is that in an economy made by perfectly competitive markets, resource allocation is ultimately driven by the "free" choices of individual consumers, a fact which is referred to as consumer sovereignty. It is clear that such assumptions are inconsistent with sustainability goals. As long as consumers are selfish and insatiable, they cannot care about sustainability, which means recognizing the limitedness of resources (and hence their inability to satisfy unlimited wants), and taking care of future generations (i.e. having other-regard preferences). As long as policy makers do not recognize that preferences are endogenous, they will not implement policies aimed at removing socio-cultural and informative constraints which bind consumers to

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unsustainable consumption habits. Moreover, as long as they do not recognize the bounded rationality of consumers, they will not provide them with the informational and educational assistance which is needed in order to fill the knowledge-to-action and the behavior-impact gaps.

In a real economy populated by non-competitive markets and by economic actors with bounded rationality, market-based instruments (i.e. taxes/charges and incentives/subsidies) prove to be ineffective in driving the system towards given sustainability goals. Moreover, sustainable products often exhibit the characters of public goods, for which the market fails to supply the socially optimal amount. Therefore, contrary to what policy makers have done so far, command-and-control instruments (standards and regulation) should be preferred, together with the public provision of sustainable goods and services.

Table 1. Improving policy efforts towards consumption sustainability

Factors limiting consumption sustainability	What we have learnt	Looking for new perspectives and strategies of intervention
Rebound effect	Markets and economic incentives may fail to promote sustainability. Limits of voluntary individual actions as drivers of change.	Standards and regulations should be preferred in place of market incentives. Developing governance innovation based on cooperative collective action.
Knowledge-to-action gap	Consumer theory needs to acknowledge: - Bounded rationality. - Endogenous preferences. - Socio-cultural embeddedness of economic activities. - Structural constraints.	Abandoning the myth of consumer sovereignty. Improving public information and education. Standard and regulation in order to remove structural constraints, limit corporate power and facilitate cultural change.
Behavior-impact-gap	Bounded rationality. Shortsighted behaviors. Limits of voluntary individual actions as drivers of change.	Standards and regulations. Promoting "green" social capital. Public research and assistance to assess and monitor the environmental impact of production/consumption alternatives.
Strong vs. weak conception	An individualistic consumerist society is incompatible with sustainability. Sustainable consumption cannot emerge from utilitarianism.	Abandoning the myth of perpetual growth and consumer insatiability. Developing ethical, social and cultural norms endorsing less materialistic values and lifestyles.

Finally, when a strong sustainable consumption perspective is accepted, the required changes in lifestyles and values can be achieved only by abandoning utilitarianism as the sole moral theory underpinning economic and political actions. Utilitarianism, and in particular preference utilitarianism, does not help address the main ethical issues raised by sustainability concerns (Barker et al., 2008): equity, across social groups living today and across generations; moral accountability in case of uncertainty and risk (for example in the case of controversial forecasts on the effects of global warming), as assumed instead by the precautionary principle endorsed by Jonas' imperative of responsibility; the upholding of human rights; the recognition of the intrinsic value of human life and nature; the recognition of the rights of nature; choice problems in case of trade-offs between different policy options and redistributive problems. Given these shortcomings of utilitarianism innovative policies for the promotion of sustainability need to be based on different ethical foundations, such as deontological and virtue-based theories. These moral theories, which are about duties and universal norms are consistent with a kind of human being committed to the well-being of others and of nature and willing to enjoy aesthetic goods besides the material ones. Moreover, they provide an option for tackling the dilemmas of guaranteeing positive rights, choosing the "right" option in case of trade offs, and attributing "per se" values to nature and to the well-being of future generations[1].

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[1] Common criticisms of these moral systems are that they are subjective, may give raise to paternalistic and anti-libertarian institutions, do not help choose between contrasting duties and rules, may lead to "inefficient" behaviors (because they do not give enough importance to the consequences of actions). Moreover, they are refused by mainstream economists on the ground that, contrary to utilitarianism, they would make resource allocation dependent on value judgments instead of efficiency. These criticisms lose their validity when dealing with real problems of economic policy. As a matter of fact, mainstream economics is not value-free because it needs deontological ethics in
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At the moment, what seems to strongly hamper the switch towards new perspectives and strategies of intervention, such as those suggested in figure 1, is the overwhelming spread of neoliberal ideology throughout the world. According to neoliberalism, the economic sphere is independent from the social and political one and states ought to abstain from intervening in the economy, allowing individuals to participate in free and self-regulating markets, which are deemed to be able to ensure maximum social welfare. Neoliberal ideology strongly endorses utilitarianism, consumerism and unlimited economic growth. With respect to consumption sustainability policies, it only accepts interventions aimed at correcting those informative problems which obstacle consumer decision processes. Command-and-control instruments are considered to be detrimental to individual freedom and to social welfare, while market-based instruments receive only partial approval.

3. SUSTAINABLE FOOD CONSUMPTION: DEFINITION AND POLICIES

In a broad perspective "food consumption to be sustainable has to be safe and healthy in amount and quality; and has to be realized through means that are economically, socially, culturally and environmentally sustainable – minimizing waste and pollution and not jeopardizing the needs of others" (Reisch, 2010). According to this definition, policies aimed at food consumption sustainability may include a variety of goals, such as (Power, 2010; Wolff and Schonherr, 2011): protecting the environment and natural resources, with a special focus on water, soil, climate and biodiversity; promoting human health; supporting rural economies; promoting animal health and welfare; preserving socio-cultural food diversity; meeting the nutritional needs of the less well off people.

A prerequisite for promoting consumer behavior changes able to meet such a wide range of goals is a clear understanding of the relationship between sustainability and dietary habits. Since the nineties, economists and industrial ecologists have produced a rich body of theoretical models and field research analysis which clarifies the environmental consequences of diets and offers sound frameworks for evaluating alternative diets from several points of view simultaneously (Duchin, 2005).

Early life-cycle studies of food examined the environmental impact of different food consumption baskets in terms of energy and land use. When studying the Swedish case, Carlsson-Kanyama and Faist (2000) found evidence of a higher use of energy in the production of animal compared to plant food, greenhouses in comparison to open-air cultivations, and processed in relation to fresh foods. Comparing European and U.S. diets with respect to land requirements, Gerbans-Leenes and Nonhebel (2002) found a substantially higher use of land for the U.S diet (even standardized to a common energy intake), due to higher meat consumption. Using material flow analysis and Economic Input-Output Life Cycle Assessment (EIO-LCA) methods, successive studies have tried to measure the sustainability of complete food production/consumption systems, taking into account the various activities along the food chain and the effects of dietary changes on the whole economy. Further research efforts have pointed to the worldwide framework, exploring the interconnection between dietary changes in affluent and poor countries (Fuchs and Lorek, 2000). Results from this broad array of research are various and sometimes contradictory; nevertheless, there is almost complete agreement on at least three points (Duchin, 2005): for food consumption to be sustainable, a shift from a meat-based to a plant-based diet should occur at a global level; the most sustainable diet (including environmental, economic and health dimensions) seems to be the Mediterranean diet, defined as a diet rich in fresh fruit and vegetables and low in meat, added sugar, salt and saturated fatty acids; reducing food miles and processing helps to reduce energy use and carbon emissions.

Inducing the dietary changes required for food consumption sustainability is a challenging political task. As argued by Fuchs and Loreck (2005) a strong sustainable consumption approach, which applies in the case of radical dietary changes, is highly unpopular both with consumers and businesses. Discussion of eco-efficiency and green innovation meets general consensus, but when it comes to consuming (and producing) less, the enthusiasm wanes. Moreover, dietary habits, even more than other consumption habits, are influenced by rigid social and cultural norms, together with individual psychological factors, which can hardly be changed by public intervention. Consequently, all the difficulties described in the previous paragraph regarding sustainable consumption interventions apply in the case of food consumption. In

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order to justify and to endorse the set of rights concerning property and contracts, which enable the market to develop and function (Van Staveren, 2007).
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particular, the greatest obstacle to dietary change appears to be the moral theory endorsed by modern societies and policy makers alike.

In a recent article Vinnan and Tapio (2012) have clearly highlighted the connection which exists between ethics, sustainable diets and modernity[2]. They classify five possible paths towards food sustainability according to the endorsed moral theory (deontological v.s instrumental ethics) and to the moving forwards (late-modernity) or backwards (pre-modernity) as regards the distinctive cultural/institutional traits of modernity. They call these five paths: deep ecology, deep modernization, preservation thinking, ecological modernization and green revolution. Each path is described on the basis of four aspects: the embraced moral and economic theories, the type of diet and the kind of food production organization. As shown in figure 1, deep ecology and preservation thinking entail a journey back to pre-modernity. In order to maintain the advances of modernity in terms of individual rights and democracy, one from among the other three paths (namely: green revolution, ecological modernization and deep modernization) should be chosen. Green revolution is the path consistent with the neoliberal ideology, endorsing neoclassical economics and a business-as-usual scenario. Being based on utilitarianism, which is useless when dealing with problems of sustainability, this path needs to be discarded in favor of the other two paths, which are supported by a deontological moral perspective. When choosing between these remaining paths, deep modernization is definitely the one which is fully consistent with sustainable food consumption, since it assumes a plant-based diet and polycultured vegetable production that enables biodiversity to be sustained. "In deep modernization, technological modernization is seen as part of the solution to the environmental crisis, but a value change in people's attitudes towards other life forms is also emphasized; the question of life is central and there is emphasis on the inherent value of production animals" (Vinnari, 2010). The accent on growth, although intended as neo-growth (i.e. based on the dematerialization of production and a new concept of well-being, as stated by Kaivo-oja et al, 2011), and faith in human reason and innovation, place the perspective of deep modernization well within the boundaries of modernity. Furthermore the required radical change of lifestyle for the majority of the population turns out to be part of the modernization process, which, in a way, may be intended as the ability of society to undergo profound value changes and transformations.

The overall extant literature, whose main results have been briefly outlined so far, gives clear suggestions as to what a viable and effective public intervention for promoting food consumption sustainability would be like. A first set of suggestions refers to the main goals that should be pursued, namely: a switch from an animal to a plant based diet; lessening food waste at home; purchasing more seasonal, local and eco-labeled products. A second set of suggestions refers to policy strategies. These should include a balanced mix between command-and-control instruments (mainly in terms of choice-editing, i.e. the process of removing the least sustainable products from the market place, and minimum eco-standards), market-based instruments (for instance taxes on animal products and incentives to buy fresh vegetables), and education and information campaigns (aimed at rising consumers' sustainability awareness and removing informative and cognitive obstacles which cause the knowledge-to-action and the behavior-impact gaps). A third, and perhaps the most important, suggestion is that in order for any intervention to be successful, a change in the ethical principles currently shaping economic theory and consumer behavior needs to take place. An effort must be made at theoretical and at practical behavioral levels in order to substitute utilitarianism with deontological (intrinsic-value based) moral theories, consistent with the lifestyle changes required by food consumption sustainability. Since this cultural passage ought to occur whilst preserving the freedom and autonomy of individuals, in accordance with the principles of modern democracies, it should not be promoted through coercion and the "rule of law" but instead through education, persuasion and incentives.

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[2] The concept of modernity has been given many meanings by different authors in different disciplines. Nevertheless the common elements unifying the various definitions of modernity are (Wironen, 2007): modernity is clearly historically situated; modernity contrasts the law based on reason and individual freedom with the law based on powers legitimized by tradition and irrational beliefs; central to modernity is the notion of progress as well of individual; in modernity, the individual reigns supreme, as the source of progress and enlightenment. In other words, modernity is about the self-realization of individual man, which can be achieved through the application of reason.

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Figure 1: Different paths towards food consumption sustainability
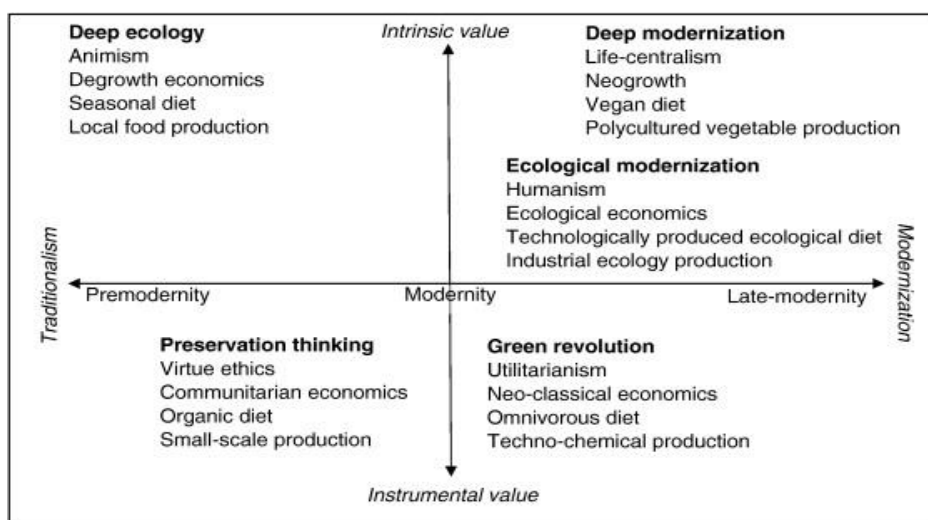
Source: Vinnari and Tapio, 2012

4.   CHILDREN AND SUSTAINABLE FOOD CONSUMPTION: A CASE STUDY

In this section the results from a recent survey on dietary habits among children in the municipality of Naples are used in order to assess the current food consumption sustainability in the area and to understand what could be the role of school nutrition education policies for redirecting food consumption towards more sustainable patterns.

Data on children's dietary habits was collected during an extensive survey recently carried out at the University Federico II of Naples. The survey involved a random sample of public primary schools (34 schools) selected from those involved in food education programs. 2127 children aged between 9 and 11, enrolled in the 5th class, were given a questionnaire during a face-to-face interview. The survey was carried out by trained interviewers in order to overcome response bias due to the limited cognitive ability of many children when estimating the kind and amount of food consumed.

Food consumption sustainability was measured by comparing the actual children dietary habits with the Mediterranean diet (MD) pattern. At international level, the generally accepted definition of MD pattern (Key et al., 1986; Nestle 1995; Bach et. al., 2006) refers to a diet which is varied, not very caloric and based on fresh, local and seasonal products, whenever possible. This pattern is represented in the Mediterranean Diet Pyramid, a graph indicating that daily intake should be mainly composed of foods of vegetable origin. Cereals, fruits, vegetables, pulses and nuts are located at the base of the pyramid. On the next level are foods that should be consumed in lower quantity and less frequently: dairy products, potatoes, poultry, eggs. At the top of the pyramid are foods for occasional consumption, sweets, meat and its derivatives (Willett et al., 1995). The MD is also characterized by the use of olive oil as the main source of fat, the presence of moderate wine intake at meals and a frequent intake of fish, based on the proximity to the sea. The adherence of Neapolitan children to the MD was assessed using an ad hoc Mediterranean Diet Quality Index (MDQI). In epidemiological studies[3], indexes evaluating the adherence to MD may be classified in three categories (Bach et al., 2006; Sofi et al., 2008): (1) those based on a positive or negative scoring of the diet components, with positive scores assigned to dietary components consistent with MD (Trichopoulou et al., 2003;Serra-Majem, 2004; Trichopoulou et al. 2005; Lazarou et al.2009; Romaguera at al. 2010) (2) those that add or subtract standardized components (Alberti-Fidenza et al.,2004¸ Alberti et al.2009); (3) those that are based on a ratio between components. The MDQI belongs to the first category and is adapted from the KIDMED index previously used by Serra-Majen et al. (2004) e da Lazarou et al. (2009). Table 2 shows the main

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[3] Since Mediterranean diet patterns are inversely correlated with prevalence of risk factors for non-communicable diseases, epidemiological studies use various methods to evaluate the adherence of a population to the Mediterranean diet.

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differences between the MDQI and the KIDMED[4]. The MDQI was obtained additively combining two groups of 13 basic indicators (see table 2) equally weighted. The first group (10 indicators of positive quality) includes the indicators, which were assigned a score of +1, associated with the presence of components related positively to the MD. The second group (3 indicators of negative quality) includes indicators signaling harmful dietary habits, with a score of -1. Consequently, the MDQI ranges between -3 and +10.

In the following lines we first discuss MDQI estimates for all the children (MDQI absolute frequencies), in order to define the general food habits patterns; then, we discuss the results of a hierarchical cluster analysis (using the 13 basic indicators as aggregation variables), which allows us to classify different behavior typologies.

Table 2. The main differences between the MDQI and the KIDMED

	Score	MDQI - Mediterranean Diet Quality Index	KIDMED – Mediterranean Diet Quality Index in children and adolescents.
Positive score Index - High adherence to Mediterranean Diet			
Takes a fruit or fruit juice	+1	every day	every day
Has a second fruit	+1	every day	every day
Has fresh or cooked vegetables regularly	+1	once a day	once a day
Has fresh or cooked vegetables more than	+1	once a day	once a day
Consumes fish regularly	+1	at least once a week	at least 2–3 times per week
Eats pulses	+1	at least once a week	more than once a week
Consumes pasta or rice almost	+1	5 or more times at lunch	every day (5 or more times)
Has a dairy product for breakfast (yoghurt, milk,…)	+1	every day	every day
Has cereals or grains (bread, etc.) for breakfast	+1	every day	every day
Takes a second yoghurt	+1	every day	every day
Consumes nuts regularly	+1	-	(at least 2–3 times per week)
Uses olive oil at home	+1	-	every day
Negative score Index - Poor adherence to Mediterranean Diet			
Has commercially baked goods or pastries for breakfast	-1	every day	every day
Skips breakfast	-1	always or often	
Takes cake or sweets and candys	-1	Cake more than once	Sweets and candy several
Goes to a fast-food restaurant (hamburger)	-1	-	more than once a week

Absolute frequency distributions of the positive quality indicators help to understand the main dietary deficiencies of Neapolitan children. The consumption of pulses, fish and fruit is quite satisfactory, even if it is still low compared with MD principles. 89% of children eat pulses and fish at least once a week and 74% eat fresh fruit once a day regularly. Intake deficiencies were found instead for yoghurt, pasta or rice (at lunchtime), vegetables and grains for breakfast.

Particularly worrying is the low consumption of vegetables, with only 49% of children eating them once a day on a regular basis. Frequency distribution of the three negative quality indicators points to breakfast as the critical point of Neapolitan children's diet. About one third of children do not have breakfast regularly and 61% eat pastries for breakfast. In general there is an over-consumption of cakes, with 51% of children eating them more than once a day.

A better characterization of children's dietary habits was obtained through a hierarchical cluster analysis, preceded by a principal components analysis which used the 13 basic quality indicators as original variables. Results are reassumed in table 4, where the five obtained clusters are sorted in descending order with respect to the MDQI mean value.

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[4] The MDQI index that we propose in this article is slightly different from the KIDMED index originally proposed by Serra-Majem et al , 2004. The MDQI does not contain information on the consumption of nuts and olive oil at home, and on the number of meals eaten at fast food restaurants. Furthermore, the MDQI assigns a positive score for lower pulse and fish consumption.
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Table 3. MDQI and basic quality indicators – Frequency distributions and scores

	MDQI		Positive score Index High adherence to Mediterranean Diet												Negative score Index Poor adherence to Mediterranean Diet		
			Pulses (at least once a week)	Fish (at least once a week)	Fruit (once a day regularly)			Milk or Yoghurt for breakfast	Pasta or Rise at lunch	Vegetables (once a day regularly)	Cereals or grains for breakfast	Fresh fruit	Yoghurt	Vegetables	Pastries for breakfast	Cake	No Breakfast
Score	Cumulative frequency distribution	Absolute frequency distribution			Fresh	Juice	Total					more than once a day	more than once a day	more than once a day		more than once a day	Always Often
-2	0,38	8	4	2	1	1	2	0	0	0	0	0	0	0	8	8	8
-1	2,49	45	25	16	6	3	9	10	3	2	1	0	0	0	38	38	35
0	7,19	100	75	52	21	9	30	40	12	15	6	0	3	0	85	78	70
1	15,70	181	139	108	67	31	98	99	45	39	20	4	10	2	153	137	93
2	28,77	278	236	204	165	24	189	157	131	81	48	11	20	3	200	194	130
3	46,03	367	333	296	270	22	292	260	206	145	82	46	27	19	250	217	138
4	62,44	349	322	297	300	11	311	263	264	183	113	76	61	38	224	195	113
5	78,14	334	319	300	304	12	316	287	272	192	134	115	58	58	180	138	63
6	89,75	247	241	235	243	2	245	216	214	187	134	135	61	38	120	60	44
7	95,16	115	111	112	114	0	114	102	101	105	81	72	41	44	37	22	19
8	98,40	69	68	68	69	0	69	66	66	66	52	55	29	40	19	6	2
9	99,62	26	26	26	26	0	26	26	26	26	23	23	16	19	3	0	0
10	100,00	8	8	8	8	0	8	8	8	8	8	8	8	8	0	0	0
Number of cases		2.127	1.907	1.724	1.594	115	1.709	1.534	1.348	1.049	702	545	334	269	1.317	1.093	715
%		(100,00)	(89,66)	(81,05)	(74,94)	5,41	(80,35)	(72,12)	(63,38)	(49,32)	(33,00)	(25,62)	(15,70)	(12,65)	(61,92)	(51,39)	(33,62)

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Table 4. Cluster analysis – results

	Total	Cluster1	Cluster2	Cluster3	Cluster4	Cluster5
Number of cases (n.)	2.127	250	223	1.037	215	402
%	100,00	11,8	10,5	48,8	10,1	19,0
Clustering variables						
MDQI (mean value)	3,75	6,2	5,28	4,02	1,96	1,69
KnI (mean value)	3,67	3,98	-	-	3,12	-
Positive score Index - High adherence to Mediterranean Diet						
Takes a fruit or fruit juice every day		**yes**	*(yes)*	*(yes)*	-	**no**
Has a second fruit every day		*yes*	yes	yes	**no**	***(no)***
Has fresh or cooked vegetables regularly once a day		***(yes)***	-	-	**no**	no
Has fresh or cooked vegetables more than once a day		***(yes)***	***(no)***	***(no)***	**no**	**no**
Consumes fish regularly (at least once a week)		**yes**	-	**yes**	*no*	*no*
Eats pulses at least once a week		-	***(yes)***	***(yes)***	***(no)***	***(no)***
Consumes pasta or rice almost every day (5 or more)		yes	yes	**yes**	-	***(no)***
Has a dairy product for breakfast (yoghurt, milk, etc.)		-	-	-	-	-
Has cereals or grains (bread, etc.) for breakfast		yes	yes	-	-	-
Takes the 2nd yoghurt		-	yes	-	-	**no**
Negative score Index - Poor adherence to Mediterranean Diet						
Has commercially baked goods or pastries for breakfast		**no**	-	-	-	-
Skips breakfast always or often		no	-	-	-	*yes*
Takes cake more than once a day		no	-	yes	yes	-

Legenda

> ***(Bold and Italic): 100% of interviewed***
> **Bold: 75-99% of interviewed**
> Normal: 50-74% of interviewed
> *Italic: 25-49% of interviewed*

The first two clusters exhibit a MDQI mean value which is within the range of MDQI value score (score>4) indicating an average-good diet quality. The central cluster, with a MDQI mean value of 4.02, groups children with an acceptable diet quality, although not fully consistent with the ideal MD. Clusters 4 and 5 exhibit a very low MDQI mean value (1,69), indicating undoubtedly a poor diet. Diet quality distance, measured as the difference between the MDQI mean values, shows a progressive deterioration moving from the first to the third group, suggesting the sharing of a diet structure characterized by elements which remain positive notwithstanding the worsening of MDQI values. Moving towards clusters 4 and 5 the quality of the diet deteriorates abruptly, meaning that these two groups do not share any good dietary habits with the remaining groups. Looking at the basic quality indicators within the clusters, it is possible to identify the main points of weakness in each group. Diets in the first group lack pulses and dairy products. In the second group there is a lack of fish and vegetables while the third group is characterized by an excess of sweet consumption. The peculiar weakness points of groups 4 and 5, (which share the lack of fundamental nutrients), are, respectively, a high sweet snack consumption and bad breakfast habits. Cluster sizes indicate that while two-thirds of children have a good/acceptable diet, 30% have alarming dietary deficiencies.

Alongside questions aimed at dietary assessment, children in the Neapolitan survey were asked seven questions (knowledge indicators) useful when measuring their level of knowledge on issues related to food consumption sustainability. In particular, children were asked: - to give a definition of pulses; - to list foods that should be almost avoided or eaten in moderation; - if they had some idea of the meaning of the following terms: organic food, integrated pest management, Protected Designation of Origin (PDO), fair trade. Correct and incorrect answers were scored 1 and 0, respectively. The knowledge degree was then

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measured through the Knowledge Index (KnI), calculated by adding the scores of the seven knowledge indicators. Accordingly, KnI scores range from 0 to 7. Cumulative frequency distribution of KnI scores, shown in table 5, indicate that 43% of children have a low level of knowledge (KNi score <4), while only less than 9% have a high (KNi score >4) level of knowledge.

Table 5. KnI - Frequency distributions and scores

Knowledge Index			Pulses definition	Foods to eat al most twice a week	Organic food definition	Foods to eat al most once a month	PDO food definition	Integrated pest management	Fair trade products
Score	Cumulative frequency distribution	Absolute frequency distribution							
0	1,55	33	0	0	0	0	0	0	0
1	6,06	96	43	15	9	12	4	5	8
2	20,08	298	223	176	76	63	11	21	26
3	43,72	503	447	407	261	195	62	44	93
4	72,50	612	578	541	489	381	186	144	129
5	91,68	408	398	388	376	280	230	204	164
6	98,97	155	154	152	152	136	120	127	89
7	100,00	22	22	22	22	22	22	22	22
Numberof cases		2.127	1.865	1.701	1.385	1.089	635	567	531
%		100,0	(87,7)	(80,0)	(65,1)	(51,2)	(29,9)	(26,7)	(25,0)

5. CONCLUSION

Literature on sustainability has widely stressed that sustainable development is impossible without sustainable food consumption. Changing behavior towards sustainable food consumption entails a radical shift from an animal-based to a plant-based diet. The Mediterranean diet (MD) is regarded as a prototype model for sustainable food habits.

Efforts to promote sustainable food consumption face many obstacles and constraints, such as: the rebound effect; the knowledge-to-action and the behavior-impact gap; the alignment of consumer and business interests against strong sustainable consumption measures; the worldwide spreading of neoliberalism, which opposes regulation policies and new growth models.

Developing sustainable food school programs is an important measure which may help to promote and implement sustainable food consumption. Because the measure regards overlapping areas of policy intervention – health, education, food and environment policy- - it can take into account a wide variety of goals and instruments (Rojas et al, 2011). In particular, school food policies may pursue distributive and social justice goals based on non utilitarian ethical judgments, further to the goal of economic efficiency.

In the paper, the need for stronger food education programs has been assessed using data from a case study performed in the Neapolitan area. Results from the Neapolitan case study demonstrate that eating habits in the area have progressively switched from the traditional Mediterranean diet to unhealthy and unsustainable food models. Only less than 5% of the children interviewed showed a high adherence to MD. Negative dietary habits included: excessive consumption of snacks and junk food; low consumption of fruit and vegetables; meal destructuring; nutritional imbalance; bad breakfast habits. Furthermore, a very low understanding of nutritional and environmental problems was found in the majority of children involved in the survey.

The main conclusion of the paper is that a major effort should be made by the Ministry of Education, school managers and educators, in the field of food education intervention. Food education activities should be able not only to encourage better food habits but also to involve children in all aspects of the food system, with the aim of promoting the emergence of a new culture of sustainability, sovereignty and food security. Moreover, a further research effort is required in order to understand the influence of psychological and socio-demographic variables on children's food habits, so as to provide policy makers with information which is of practical use when choosing the best strategies and tools for intervention.

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