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EXPLORING THE REGIONAL, ECONOMIC, AND SUBJECTIVE FACTORS AFFECTING MILK CONSUMPTION IN IRAN

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Statement of Work Authorship

I declare to be the author of this work, which is unique and unprecedented. Authors and works consulted are properly cited in the text and are included in the listing of references included.

Vahid Ajorloo

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In the final stages of this Ph.D. program, I would like to sincerely thank everyone who supported me along this path. Although it is not possible to name everyone, the gratitude should be expressed to all my teachers -from the first grade of elementary school to all the teachers who have been involved and played a role in my education. First and foremost, my mother and my late father should be acknowledged as my prime guides and advisors.

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An editor has not been used in the construction of this thesis,
except for the Portuguese summary.

Faro, May 2020

Vahid Ajorloo

Summary

Achieving sustainable development goals of communities requires sustainable food security programs. Overconsumption and underconsumption of dairy products can lead to nutritional, economic and environmental aspects. This thesis deals with the factors affecting milk consumption in Iran. The thesis structure is arranged in two separate but related studies that are presented in two distinct chapters and elaborated with four supplementary chapters, namely, general introduction, literature review, research design, and final conclusion.

Using cross-sectional data related to the year 2013 (the most recent available and official data), econometric modeling was performed to explain patterns of milk consumption worldwide (chapter 4). By incorporating dummy variables, *per capita* milk consumption in 164 countries is predictable in 11 different patterns. The nonlinear econometric model also showed that milk consumption exponentially increases when HDI grows. However, each given country follows its own growth curve, based on the area in which it is present.

While the predicted value of the model was close to the actual value for many countries; it was shown that milk consumption in Iran did not follow its regional pattern. Therefore, it was concluded that non-economic factors (such as consumer attitudes) had a remarkable impact on Iranian dairy consumption.

Using a mixed-method Q technique, the second study (chapter five) discovered four distinct viewpoints in Iranian people toward milk and dairy products. Exploratory Factor Analysis was employed to identify and interpret the diversity of views. The clustering of results also showed that consumers can be divided into three distinct groups. This conclusion can be of particular interest to policymakers and marketers

In chapter six, the conclusions were discussed in detail, along with the research limitations, policy recommendations, and directions for future research.

Keywords: Milk consumption, Iran, Econometrics, Q-methodology

Sumário

A realização de objetivos e metas de desenvolvimento sustentável das comunidades requer programas sustentáveis de segurança alimentar. O consumo excessivo ou insuficiente de leite e de produtos lácteos em geral acarreta consequências nutricionais, ambientais e económicas quer a nível individual quer a nível social. O Mundo enfrenta dois grandes desafios nos setores agrícola e alimentar: por um lado, as necessidades de nutrição humana devem ser atendidas na quantidade e qualidade apropriadas; Por outro lado, os recursos naturais devem ser preservados de maneira sustentável.

A presente Tese trata dos fatores que afetam o consumo de leite no Irão. A estrutura da Tese é organizada em dois estudos separados, mas relacionados, que são apresentados em dois capítulos distintos e elaborados em quatro capítulos adicionais. Uma introdução geral, a revisão de literatura e o desenho e a metodologia de investigação são apresentados nos capítulos um, dois e três, respetivamente. Em seguida, os dois principais estudos são descritos nos capítulos quatro e cinco, respetivamente.

No primeiro estudo (capítulo quatro), foi considerada a variabilidade internacional da capitação da ingestão de leite. O objetivo deste estudo foi o de tentar esclarecer o conjunto de fatores que explicam o consumo de leite *per capita* em todo o Mundo. Foram usados dados transversais da FAO relativos ao ano de 2013 (os dados disponíveis e oficiais mais recentes) referentes à oferta de leite *per capita* que foi considerada como variável dependente. O PIB *per capita* (PPC, dólares internacionais atuais), o Índice de Desenvolvimento Humano e a taxa de alfabetização foram tratados como variáveis independentes para 164 países agrupados em cinco continentes e em 20 áreas regionais.

A variável dependente apresentou correlação positiva com todas as variáveis independentes. A construção de um modelo econométrico não linear, empregando o Eviews 10, mostrou que o consumo de leite aumenta

exponencialmente quando o IDH cresce. Todavia, cada país segue sua própria curva de crescimento, com base na área geográfica em que se encontra inserido.

A incorporação de variáveis *dummy* como variáveis explicativas para as 20 regiões do Mundo mostrou que 10 dessas variáveis se revelaram estatisticamente significativas. Todos os restantes países passaram a funcionar como a categoria base. Por conseguinte, foi demonstrado que o consumo de leite *per capita* dos 164 países pode ser explicado através de 11 padrões diferentes, nos quais o consumo de leite depende da área regional (variável qualitativa) e do IDH (variável quantitativa).

Dado que o Irão (juntamente com a Índia, o Paquistão e o Afeganistão) está localizado no sul da Ásia, esperamos que o consumo de leite no Irão siga o padrão dessa região. Enquanto que o modelo previa um consumo de 99,54 quilogramas de leite para o Irão, no ano de 2013, o valor real de tal consumo foi apenas de 46,7 quilogramas. Essa diferença notável indica que o consumo de leite no Irão não seguiu o padrão regional de países semelhantes e que outros fatores determinaram igualmente tal valor.

Nos últimos 50 anos, o consumo de leite *per capita* em diferentes países do Mundo variou de menos de quatro a mais de 400 quilogramas por ano. A média global desse valor aumentou de 76,8 quilogramas em 1961 para 112,9 quilogramas em 2013. No entanto, outros fatores precisam ser considerados para explicar a discrepância entre o consumo de leite no Irão e no Mundo. Além de razões económicas, as opiniões e as crenças dos consumidores parecem desempenhar um papel muito importante nesse sentido.

O segundo estudo (capítulo cinco) tratou das perspetivas dos iranianos sobre leite e produtos lácteos. Usando uma técnica Q de método misto, este estudo teve como objetivo descobrir a diversidade de atitudes do povo iraniano em relação ao leite e aos produtos lácteos. A Análise Fatorial Exploratória (Método do Componente Principal e rotação Varimax) foi empregue para identificar e interpretar a diversidade de visões.

Realizando seis entrevistas profundas semiestruturadas com especialistas da indústria e do mercado de laticínios, além de autoridades académicas e institucionais, o Concours deste estudo moldou e enriqueceu-se

através da revisão da literatura e de outras fontes de informação. 30 extratos foram extraídos como amostra Q e 25 participantes intervieram no procedimento de classificação Q. Quatro fatores significativos foram extraídos como quatro pontos de vista distintos sobre leite e produtos lácteos. De acordo com esses quatro pontos de vista, os consumidores podem ser agrupados em quatro categorias distintas, tal como se apresenta:

- Apreciadores
- Consumidores desconfiados (preocupados com a saúde)
- Compradores Indiferentes
- Clientes comuns (economicamente preocupados)

Resumindo e integrando os resultados dos dois estudos, as conclusões gerais podem ser resumidas da seguinte forma:

- No curso da História e em todo o Mundo, vários padrões de consumo de alimentos foram formados de acordo com os recursos acessíveis internamente;
- Os hábitos criam-se e evoluem ao longo do tempo, principalmente no longo prazo. As tendências de oferta de leite nos últimos 50 anos mostram que a ingestão de leite aumentou em muitos países;
- O IDH revela-se, por si só, como bastante significativo para explicar a quantidade de oferta de leite em todo o Mundo. No entanto, cada país tem sua própria curva de crescimento correspondente à respetiva área geográfica. As curvas de crescimento da oferta de leite exibem uma natureza exponencial, o que implica que mesmo um pequeno aumento no IDH conduziria a maiores aumentos no consumo de leite;
- Alguns países não seguem o padrão regional de consumo de leite em que estão localizados. Nesses países, outros fatores, especialmente os padrões de consumo de laticínios e as atitudes das pessoas em relação ao leite e produtos lácteos, devem ser levados em consideração;
- Fatores económicos devem ser considerados fatores de incentivo, ao invés de detonadores iniciais do processo;
- A consciencialização crescente acerca de questões nutricionais afeta gradualmente os padrões de consumo de alimentos em relação a escolhas alimentares mais saudáveis. Por outro lado, comportamentos

habituais, em associação com barreiras económicas, tendem a oferecer resistência às mudanças.

No capítulo seis, as conclusões foram discutidas em detalhe, juntamente com as limitações da investigação, as recomendações de políticas e as orientações para investigações futuras.

Palavras-chave: Consumo de leite, Irão, Econometria, Metodologia Q

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ABBREVIATIONS LIST

4A's	The 4A's of the marketing mix (*i.e.* Acceptability, Affordability, Accessibility, and Awareness)
4C's	The 4C's of the marketing mix (*i.e.* Consumer wants and needs, Consumer's cost, Convenience to buy, Communication)
4P's	The 4P's of the marketing mix (*i.e.* Product, Price, Place, and Promotion)
7P's	4P's plus further elements (*i.e.* Process, People, and Physical evidence)
AIDS	Almost Ideal Demand System
AR	Autoregressive model
EUFIC	The European Food Information Council
FAO	The Food and Agriculture Organization of the United Nations
FAOSTAT	The Food and Agriculture Organization Corporate Statistical Database
FMCG	Fast-Moving Consumer Goods
GDP	Gross Domestic Product
HC	Heteroscedasticity-consistent
HDI	Human Development Index
HFCS	Household Food Consumption Survey
IDF	The International Dairy Federation
IRI	The Islamic Republic of Iran
IRICA	The Islamic Republic of Iran Customs Administration
LIT	The adult literacy rate among people aged 15 or over
MoA	The Ministry of Agriculture (of Iran)
MoC	The Ministry of Cooperation, Labor and Social Welfare (of Iran)
MoHME	The Ministry of Health and Medical Education (of Iran)
MRC	Majlis Research Center (Affiliated to Islamic Consultative Assembly (of Iran))
OLS	Ordinary least squares (method in regression)

PPP	Purchasing power parity
Q	Q methodology
R	R-technique compared to Q-methodology
RESET	Ramsey Regression Equation Specification Error Test
SCI	The Statistical Centre of Iran
SE	Standard error
UN	The United Nations
UNDP	The United Nations Development Programme
UNEP	The United Nations Environment Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNSD	The United Nations Statistics Division
WB	The World Bank
WHO	The World Health Organization

1 GENERAL INTRODUCTION

*"To raise new questions, new possibilities, to regard
old problems from a new angle, requires creative
imagination and marks real advance in science."*

- Albert Einstein

1.1 Introduction

1.1.1 Background of this research

Achieving sustainable development goals of communities requires sustainable food security programs. Too much or too little consumption of milk and dairy products result in nutritional, environmental, and economic consequences on individuals and societies as well. The World faces two major challenges in the food and agriculture sector: On the one hand, human nutrition needs must be met in the appropriate quantity and quality; On the other hand, natural resources must be preserved in a sustainable manner.

Milk is recognized as one of the main sources of calcium and high-quality protein. In many countries of the World, milk plays an important role in meeting nutritional needs. According to the FAO (The Food and Agriculture Organization of the United Nations): there is no universally prescribed amount for milk consumption (FAO, n.d.-f). Typically, each country provides and updates its national dietary guidelines based on factors such as local conditions, nutritional needs, local access to commodities, and costs (*ibid.*).

Due to differences in these factors, recommendations may vary; However, most guidelines emphasize consuming two to three servings of milk daily; or their equivalents of dairy products. Figure 1-1 shows the guideline developed by the Ministry of Health and Medical Education of Iran. As stated by the Ministry,

consuming two to three servings of milk and dairy products is recommended for health and vitality; which will be equivalent to 150 to 225 kilograms *per* year. However, according to the FAO, Iran's *per-capita* milk supply has never been exceeded 80 kg (FAO, n.d.-b).

Figure 1-1 Iranian food-based dietary guideline

Source: Ministry of Health and Medical Education of Iran, cited in (FAO, n.d.-c)

Figure 1-2 compares Iran's *per-capita* milk supply with the global averages across five continents over the past half-century. In addition to the many ups and downs during the past half-century, there are remarkable differences between milk consumption across different continents. However, there are also several counterexamples which will be discussed in section 1.4 below (Contributions of this research), and in more detail in chapter 4.

At first glance, it may seem that such differences in milk consumption are related to the geographical location of the countries (*e.g.* environmental capacity, availability, and consumption patterns associated with the regions). According to the literature -that will be introduced in the following chapters- geographical factors play an important role in determining the type and amount of food consumption in each region. However, as can be seen in Figure 1-3, there is a significant difference, for example, between the milk consumption of Iran and its neighboring countries in the same geographical region. More importantly, the effect of this factor on the amount of milk supply has not been measured, so far.

According to the literature, e.g. (Mozaffarian, Angell, Lang, & Rivera, 2018), a set of influencing factors can be listed in this regard. Disposable income in comparison with the price of products (as purchasing power) is typically considered as one determining factor to predict consumption. While different definitions[1] of income are used to determine/predict consumption over a period of time <u>within</u> a society, other factors are also involved in studying consumption differences <u>across</u> societies.

Figure 1-4 shows that the economic prosperity of countries (*e.g.* their GDP *per capita*) cannot alone illustrate their *per capita* milk consumption. It is seen that countries with almost similar incomes have ten times difference in milk consumption. On the other hand, there are countries with the same milk consumption and ten times the difference in income.

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[1] *i.e.*, Current Income, Relative Income, or Permanent Income, respectively stated by Keynes, Duesenberry, and Friedman (Keynes, 1936), (Duesenberry, 1949), and (Friedman, 1957).

Figure 1-2 Milk consumption trend across the World for half a century

Source: OurWorldinData.org adopted from FAOSTAT (FAO, n.d.-b)

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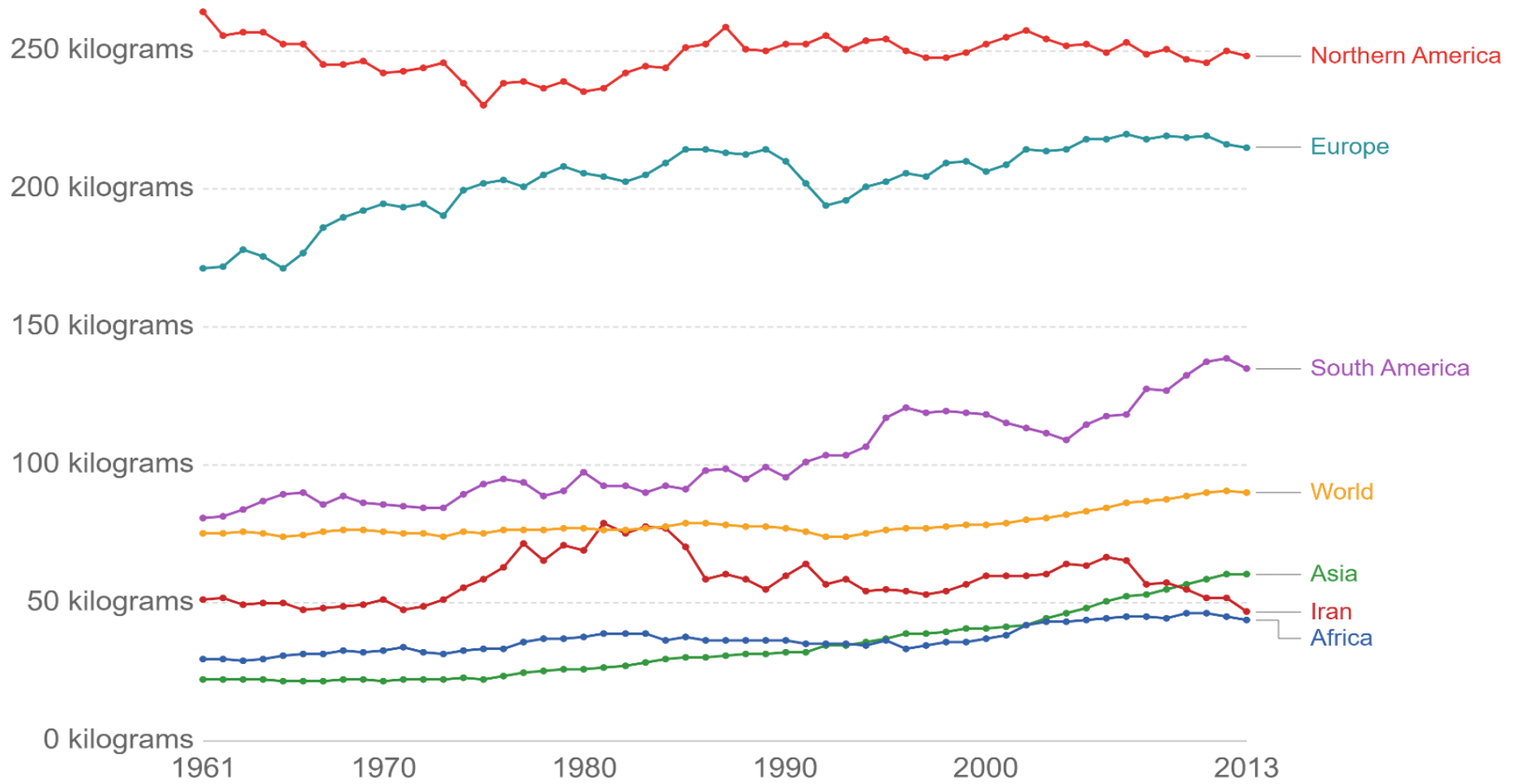
Figure 1-3 Milk supply in Iran and neighboring countries (Kg/*capita*/year) – 2013
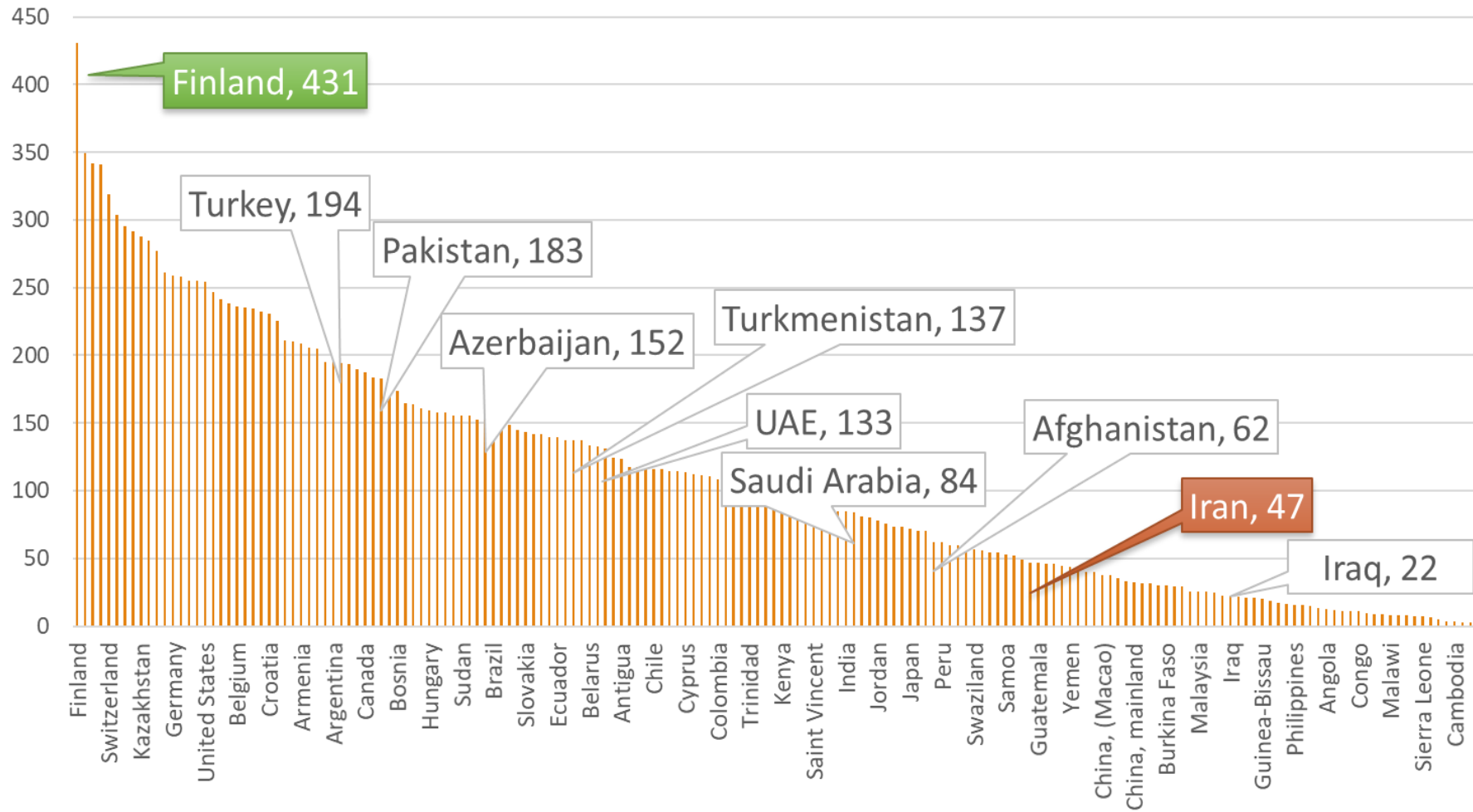
Figure 1-4 *Per capita* milk supply (Kg) vs. GDP *per capita* (PPP Constant Int. $) 2013
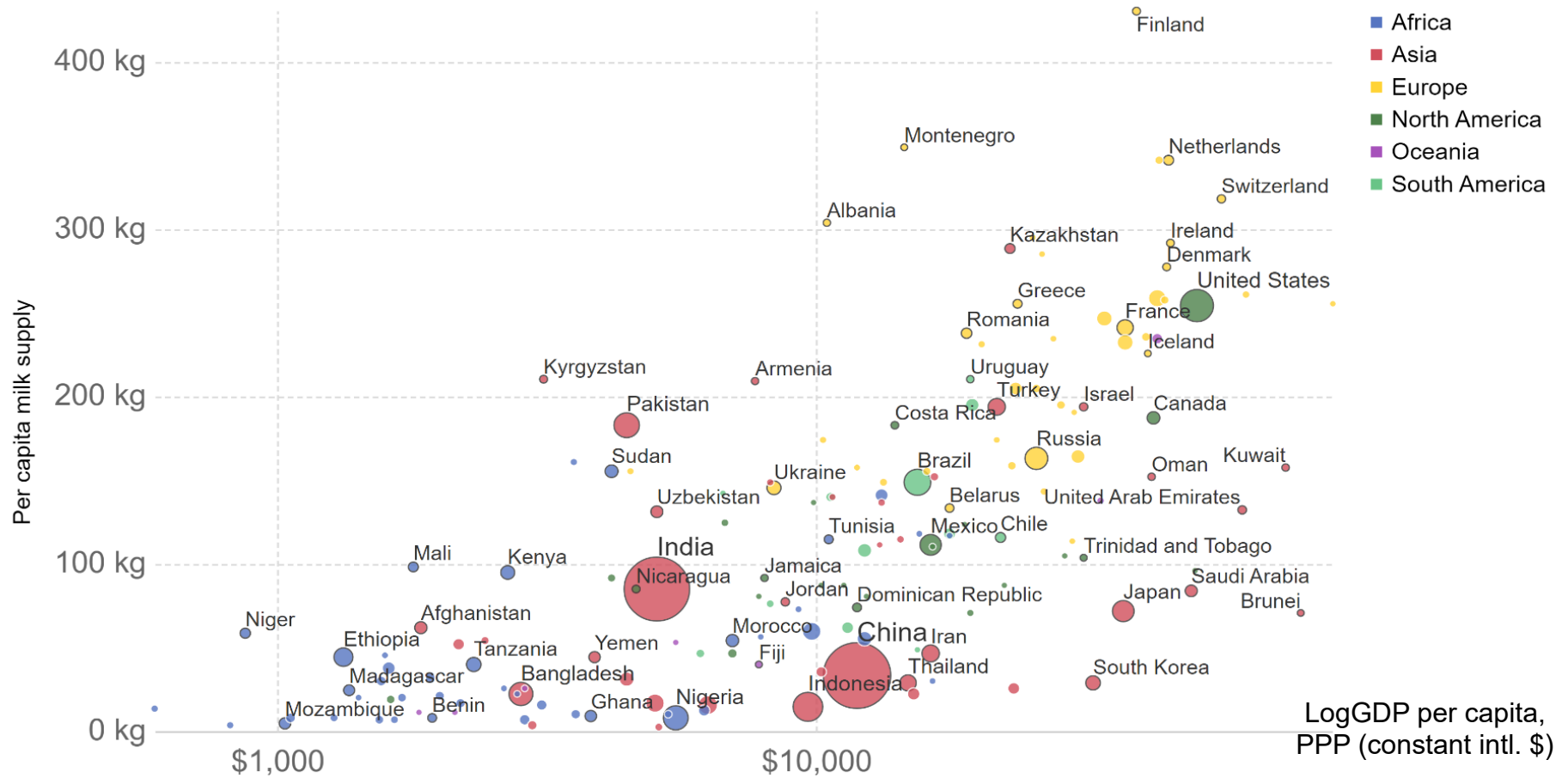
Source: OurWorldinData.org adopted from FAOSTAT (FAO, n.d.-b) and the World Bank (WB)

Other factors, such as the amount of production, import, and export, also affect the quantity of supply and consumption of a commodity. According to the Ministry of Agriculture, milk production in Iran, especially in the last twenty years, has been steadily increasing (Ministry of Agriculture, n.d.). Increasing domestic production has led to increased exports and reduced imports[2] of dairy products (Statistical Centre of Iran, n.d.). However, *per capita* domestic consumption has been declining, especially in the last ten years.

Officials and institutions have repeatedly identified the elimination of subsidies as one of the main reasons for the decline in milk consumption. According to the Majlis Research Center -affiliated with the Islamic Consultative Assembly [parliament] of Iran- the removal of subsidies has had a significant impact on milk consumption (Majlis Research Center, 2015). According to the central bank's annual report, as cited in (Majlis Research Center, 2015), *per capita* milk consumption has fallen sharply since the elimination of subsidies.

Officials from the Ministry of Health, the Nutrition Association, the Institute for Nutrition Research, and academic sources have also repeatedly pointed to calcium deficiency in the Iranian diet and have announced the elimination of subsidies as a factor of reduced consumption.

While subsidies are important in facilitating economic conditions (for both producers and consumers), the following should also be kept in mind:

1. Even when subsidies were paid, Iran's *per capita* consumption of dairy products has never exceeded 80 kg *per* year.
2. Despite higher prices and lower nutritional value, the consumption of some unhealthy foods is much higher than the consumption of dairy products.

Therefore, while emphasizing the impact of subsidies and other economic factors such as price and purchasing power, it is necessary to consider the role of other

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[2] In the past 15 years, Iran's dairy import has never exceeded three *percent* of domestic production (Majlis Research Center, 2015).

factors such as the availability (on the supply side) and the consumption patterns (on the demand side) driven by the local culture.

1.1.2 Nutritional necessities

For thousands of years, milk and dairy products have made a significant contribution to the human diet in many communities. "Milk is a major source of dietary energy, protein, and fat" (FAO, 2013, p. 43). "It can make a significant contribution to meeting the required nutrient intakes" (FAO, n.d.-f, p. 1). In addition to high-quality proteins and fats, milk is a natural source of Calcium, Phosphorous, Magnesium, Vitamin B12, Vitamin A, Zinc, Riboflavin, Folate, Iodine, and Vitamin C (European Milk Forum, n.d.). Each of these nutrients has an important role in human nutrition and health (Figure 1-5).

Although concerns are being raised on overconsumption of milk and dairy products in the US and Europe, it should be noted that milk consumption *per capita* in the US and Europe is up to three times the global average (FAO, n.d.-b); While, in some countries, the amount is below one-third of the global average (*ibid.*). However, moderation should be observed when consuming any food. Also, different groups of people have diverse nutritional needs in various conditions and stages of life (*e.g.* infancy, childhood, adolescence, middle age, old age and also during illness, pregnancy, lactation, or for athletes).

While some of the nutrients in milk can also be obtained by consuming other foods, milk is the only food that provides all of these nutrients with an appropriate proportion suitable for human nutritional needs. For this reason, milk is known as an indispensable and irreplaceable food ingredient. It is "a unique package of essential nutrients" (European Milk Forum, n.d., p. 1).

It should be noted that economic factors are among the most important determinants of human food choice. Milk and egg are among the least expensive sources of the nutrients needed for human. However, a diverse combination of foods is essential for human health.

Figure 1-5 The nutrients in milk

Cognitive function
Thyroid function
Normal skin

Bone development
Healthy teeth
Muscle function

Nervous system function
Muscle function
Blood pressure

Reduction of fatigue
Red blood cell formation
Immune system function

Iodine
Phosphorus
Calcium
Protein
Potassium
Vitamin B2
Vitamin B12
Vitamin B5

Bone development
Healthy teeth
Energy metabolism

Muscle growth
Bone development

Nervous system function
Normal skin
Normal vision

Energy metabolism
Reduction of fatigue
Mental performance

Source: 'EU Register of Nutrition and Health Claims made on foods' as provided by (The National Dairy Council Ireland, n.d.)

Since this study is not aimed at the nutritional value of milk, further elucidation is avoided. Many studies have been done in this area. A narrative literature review from 1966 to 2013 concludes that:

> "Dairy products provide a package of essential nutrients that is difficult to obtain in low-dairy or dairy-free diets, and for many people, it is not possible to achieve recommended daily calcium intakes with a dairy-free diet."
>
> (Rozenberg et al., 2016, p. 1)

1.1.3 Economic importance

Dairy farms and products are common traditions in almost every part of the World. More than six billion people worldwide consume dairy products (Hemme & Otte, 2010). Considering the percentage absorbed, milk is the cheapest source of animal protein needed for the human body (Ajorloo, 2017). In addition to being a source of food, milk is also a source of health and vitality. Milk should be included in a regular nutrition diet to prevent diseases, disorders, and complications of osteoporosis. Tooth decay and hip fracture are costly consequences of dairy shortages for both households and health systems.

Consuming two to three servings of milk daily, recommended by the Ministry of Health and Medical Education of Iran, equals 180 kilograms of milk *per* year. This target could increase the size of the Iranian dairy market by more than 100 percent.

Demand for milk and dairy products in every society depends on both population and *per capita* milk consumption. In recent decades, the World population growth rate has been between 1.2 and 1.3 *percent* annually. At the same time, however, the average rate of growth of milk production was about 2.2 *percent* annually (IDF, 2013). As a result, the World's *per capita* consumption of milk has increased from 77 kg to 113 kg in the last 50 years.

While increasing *per capita* income [along with other economic factors] has an undeniable role in increasing *per capita* milk consumption (Hemme & Otte,

2010), cultural factors, especially awareness raising, should not be overlooked. From this perspective, the dairy sector is considered as one of the most important sources of food security in the World (IDF, 2013).

1.1.4 Employment and entrepreneurship

The Food and Agriculture Organization of the United Nations (FAO) identifies milk as a health concern for society as well as an incentive for employment, entrepreneurship and community wealth -especially in rural communities (Henriksen, 2009).

Milk production, along with its value chain (from agricultural inputs and other service providers to the distribution channels in the market) is highly labor-intensive. Estimates show that nearly one billion people live on dairy farms (Hemme & Otte, 2010). The dairy sector can play an important role in economic development, employment and poverty reduction. This sector provides a livelihood for many people, particularly poor people in rural areas.

In Iran, there are about 2.5 million dairy farmers -from traditional small-scale dairy households in the informal market to intensive dairy farms in the formal market (Ajorloo, 2017). On the other hand, over 70,000 people work directly in more than 23,000 formal livestock farms (Ajorloo, 2017). The milk industry has a wide range of sectors, from supply chain to agriculture, animal husbandry, machinery, packaging, manufacturing and processing, distribution and sales, transportation, as well as supplementary services such as banking, insurance, warehousing, *etc.* It is estimated that about four million people are directly or indirectly involved in the dairy value chain.

Any increase in milk consumption and thus milk production will lead to a significant increase in the country's employment. In particular, most of the job opportunities associated with this industry and its supporting industries are distributed throughout the country, leading to a uniform distribution of job opportunities and avoiding concentrating in the big cities.

1.1.5 Agricultural and livestock capacity

The value of raw milk produced in the World is about 300 billion USD, which is about 10 *percent* of the total value of agricultural products produced in the World (IDF, 2013). Given the relatively low price of milk, on the other hand, worldwide transportation of dairy products is costly; World trade in milk and dairy products is less than 10% of its production value. Therefore, most countries' dairy consumption is related to the amount of domestic production of those products.

Livestock breeding and milk production are the pivotal components of the World food system (FAO, 2011). They play a fundamental role in the economic and social sustainability of rural areas. Iran's climatic diversity, along with human capital, has made it possible to plant and harvest most of the crops and livestock inputs. Reportedly, given the permits issued for the construction of livestock farms, about 60 *percent* of their capacity is exploited, and the remaining 40 *percent* is unused.

According to annual reports of the Islamic Republic of Iran Customs Administration (IRICA), in the past 15 years, Iran's dairy import has never exceeded three *percent* of domestic milk production (Majlis Research Center, 2015). On the other hand, Iran's dairy exports have increased over the past ten years. In view of the above, it is observed that there exist agricultural and dairy capacities to increase milk production in Iran.

1.1.6 Processing capacity

Over the past 75 years, many capacities have been created to process a wide variety of dairy products domestically. According to the Majlis Research Center (MRC) and with reference to the Iranian Dairy Industry Association, the processing capacity of dairy products in Iran was more than 13 million tons, which was also increasing (Majlis Research Center, 2015). While actual production was less than seven million tons, it can be concluded that nearly half of Iran's dairy production capacity remains unused.

Increasing dairy consumption can lead to exploitation of this unused capacity and increase productivity, resulting in reduced cost.

1.1.7 Environmental aspects

One of the criticisms of the production and consumption of milk and dairy products is the environmental impact of the sector. Greenhouse gas emissions and water consumption are of major concerns to the industry.

It should be borne in mind that the production and consumption of any foodstuff has its own environmental consequences. It is important that human activities in this field and in all other fields are formulated and implemented in a manner that maintains environmental sustainability. On the other hand, providing human food is one of the necessities of sustainable food security. However, part of human food must come from plant sources and part from animal sources such as milk and meat. To address these concerns, it is advisable to consider over-consumption, food waste, and improved consumption patterns.

It should also be noted that the amount of feed needed to produce one kilogram of milk (Figure 1-6) is far less than the feed required to produce other livestock products (Alexander, Brown, Arneth, Finnigan, & Rounsevell, 2016).

Figure 1-6 Feed needed to produce one kilogram of livestock products
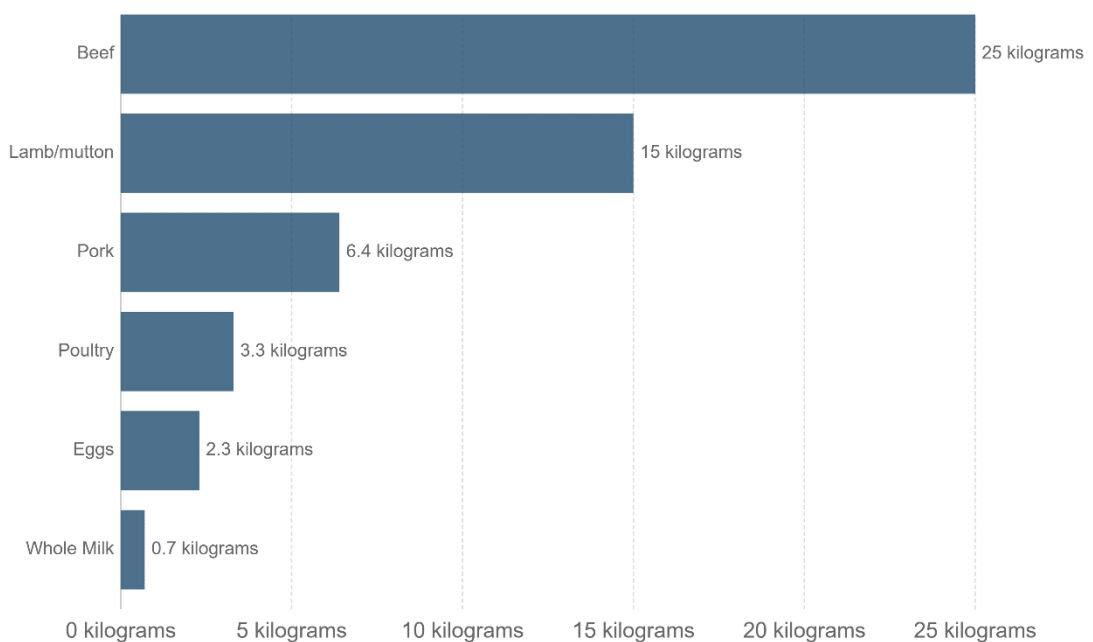
Source: (Alexander *et al*., 2016) as mentioned in OurWorldinData.org

1.2 Stakeholders

A large set of agents are present in the milk and dairy value chain. Some industries supply this chain; some others benefit from this industry. A typical dairy value chain can be illustrated in Figure 1-7. Any changes in the market and the industry, as well as policies in this area, will affect the whole chain.

Figure 1-7 Dairy value chain
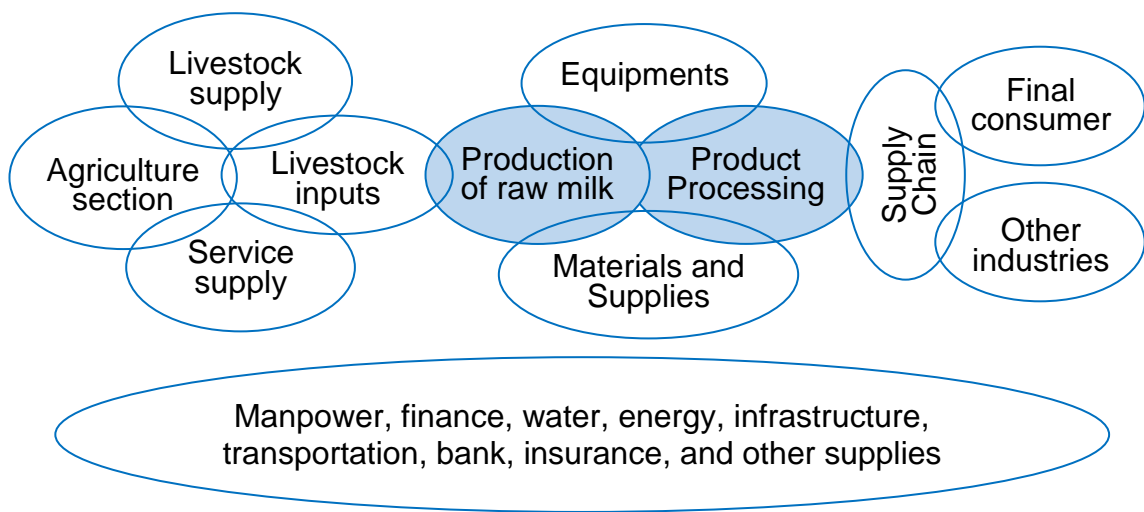
Source: developed for this research

1.3 Research objectives

1.3.1 Statement of the problem

Human knowledge in economics, marketing, and other social sciences states that the purchase and consumption of any commodity is a function of various factors such as price, purchasing power, consumption patterns, and so on. It seems that in Iranian society, these factors - though they lead to periodic fluctuations - have not affected the country's *per capita* dairy consumption.

The main concern of this research is as follows:

> 'Despite the unique benefits of milk and other dairy products, why do Iranian households consume milk and dairy products much below the recommended amount?'

Per capita consumptions of developed countries, or even the World average are not targeted due to the explanations mentioned before in the background.

1.3.2 Main objective

The main objective of this research is to identify the predominant reasons for the significant gap between Iranian *per capita* milk consumption and the recommended amount for a healthy diet.

1.3.3 Sub-objectives

- Investigation of regional factors affecting milk consumption pattern in the World;
- Analysis of economic trends (possibly time series) related to milk and dairy consumption in Iran;
- Exploration of Iranian consumers' viewpoint on milk and dairy products.

1.3.4 Research questions

The following questions are raised with regard to the research objectives:

- Given the vast disparities in countries' milk consumption, is it possible to identify the factors that drive or deter milk consumption worldwide?
- How much does each of these factors affect countries' *per capita* milk consumption?
- Can a mathematical model be set up to explain the disparities across the World?
- In addition to the factors that contribute to regional differences, what has been the trend of changes in Iran's milk consumption?

- Given the many ups and downs that have been observed in the past trend of milk consumption in Iran, can an econometric model be set up to explain the situation?
- In addition to measurable factors (such as economic ones), can behavioral factors (such as viewpoints) be considered in the study of consumption patterns?
- What do the Iranian people really think about milk and dairy products?
- How can different viewpoints be identified and extracted, if any?

1.4 Contributions of this research

Although milk and dairy products play an important role in providing public health as well as the food security of the community, and although there is sufficient capacity to produce, process and supply these products in the country, *per capita* consumption of milk is about one-third of the amount recommended by nutritionists and officials.

Filling such a gap, in addition to the health aspects and reduced financial and non-financial costs associated with diseases caused by milk deficiency, could lead to a doubling of the size of the Iranian dairy market, and consequently, lead to an economic boom in agriculture, livestock, industry, and trade sectors.

So far, many studies have been conducted on the factors affecting demand. For instance, as a general principle, we do know that rising income will lead to higher demand (with the exception of inferior goods, in the face of normal goods or superior goods). What we do not know is the nature and strength of correlation for a given commodity in a given society. The problem becomes even more complex when a combination of other factors also influences the outcome.

Non-academic explanations of the topic (the causes of low dairy consumption in Iranian households) are always raised by both individuals and officials. They always repeat generalities without clearly defining the role of each cause or factor. News reports, generally quoted from industry officials or experts, suggest that dairy cuts are affected by factors such as rising prices, reduced purchasing power, and the elimination of subsidies. Although generally speaking

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such propositions may be correct, however, they never explicitly define the contribution of variables.

Several academic studies, as well as commercial market research, have been conducted -in typically limited scopes- to understand and demonstrate consumers' preferences and behavior in confronting with diverse types of dairy products. There are reports (Ghosoori, 1393; Roghanchi, 1394) that show changes -generally decreasing- in dairy consumption over the past few years. On the other hand, one common feature in most of these studies is to refer to consumers and/or households -through interviews, questionnaires, or other means.

Studies undertaken in Iranian milk and dairy consumption have typically dealt with either nutritional concerns or marketing issues. The latter, which have been commonly reported at the individual and/or family level in different spots, have taken into account factors influencing individual decisions on milk and dairy consumption. Except for some reports provided by governmental agencies regarding the reduction of milk consumption, no scientific articles have been observed to address nationwide macroeconomic variables affecting milk consumption in the country.

However, when it comes to aggregate consumption of a particular nation or region, surveys on individuals' preferences might not be accurate enough to be generalized to the whole nation or region. More specifically, to understand long-term changes in social behavior on economic issues, macroeconomic variables might have more explanatory capabilities.

Surveys conducted by questionnaires and interviews might also suffer from concerns such as over/under-estimating and over/under-reporting, intentionally or unintentionally stated by the interviewees. On the other hand, subjective elements such as [individual] preferences, [social] influences, [cultural backgrounds,] and psychological or physiological needs (Samuelson & Nordhaus, 2010) are among qualitative concepts that may not be easily measured by quantitative methods.

More importantly, the results usually belong to the same category or class that they are sampled. The generalization of such findings to the whole country might lead to considerable misunderstandings. While studies on individuals and households can be useful for marketing purposes, macroeconomic studies can be helpful in identifying the situations as well as in policymaking.

To the Author's best knowledge, no studies have been found building an econometric model to explain Iranian milk consumption based on possible explanatory factors.

As the first attempt in this field, this research aims to:

- ❖ Provide a model to explain disparities in milk consumption across different regions of the World;

- ❖ Identify and test the significant factor(s) affecting these disparities globally;

- ❖ Make possible the ability to predict (and forecast) countries' milk consumption *per capita* according to the identified factor(s);

- ❖ Identifying the different perspectives of the Iranian people on milk and dairy products.

1.5 Scope of this research

The value chain of equipping, producing, processing, supplying and consuming milk and dairy products (Figure 1-7) is a very-large-scale complex system of the type of socioeconomic systems. Even environmental conditions, climate changes, technological developments, policies, laws, and regulations have great impacts on the behavior of this system.

Changes in the quality and quantity of agricultural inputs, import and export regulations, and such factors, have an extensive impact on the price of milk. Awareness raising, advertising, news, rumors, and scandals about the dairy industry have a profound influence on consumers' views, especially on food products.

Hence, studying the behavior of such a system goes far beyond the scope of this Thesis. For this reason, and for greater attention to consumer choice, areas that are directly related to consumer incentives were selected for the study, which include:

1. Regional (geographical) diversities that play a general and mainstream role in shaping consumption patterns worldwide;

2. Distinct viewpoints of Iranian consumers on milk and dairy products.

These two areas (Figure 1-8) will be studied in the following two domains, respectively:

1. A cross-sectional study of variables at the international level that can explain countries' milk consumption; and for which there is consistent and reliable data;

2. Extracting distinct viewpoints by studying a sample of the community.

Figure 1-8 Two main areas of study in this research

Source: Illustrated for this research

1.6 Thesis outline

Due to its multidisciplinary issue-oriented theme, this Thesis consists of two studies, presented in two consecutive chapters, and supplemented by four accompanying chapters.

The first, second and third chapters deal with General introduction, Literature review, and Research design and methodology, respectively. The fourth and fifth chapters deal with the two areas presented in section 1.5 above,

Scope of this research (Figure 1-8). Eventually, chapter 6 at the end presents the final conclusion of the research, by combining the results of the two studies. The outline for this thesis is presented in Figure 1-9.

Figure 1-9 The outline of this thesis
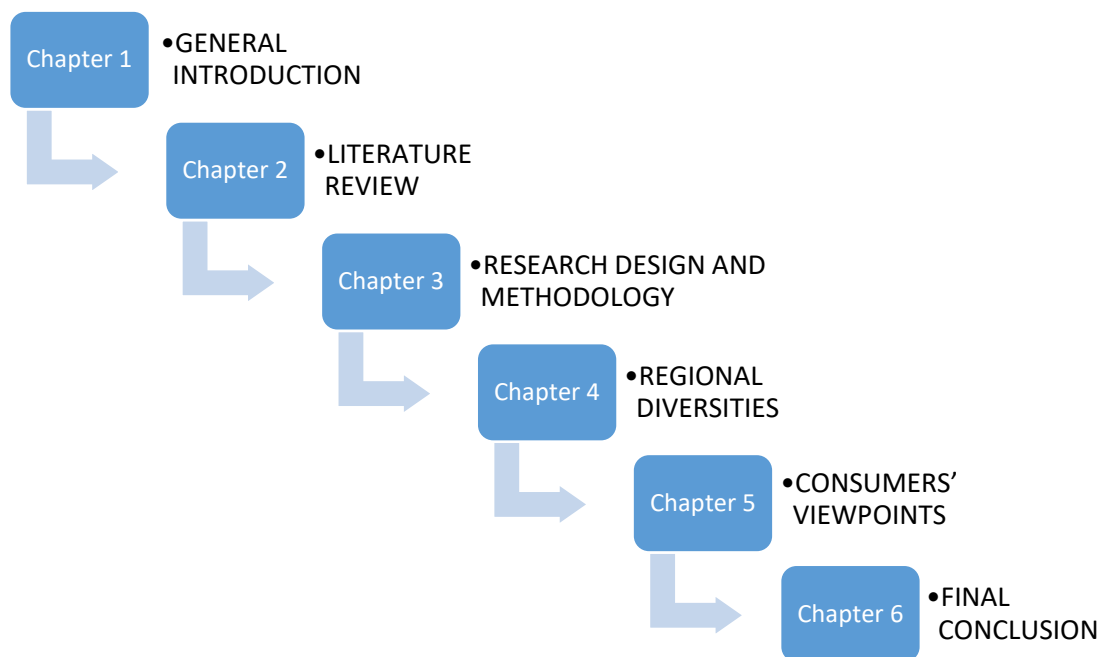
Source: Illustrated for this research

On a case-by-case basis, each of the two studies (chapters 4 and 5) provides its own specific literature review and research design. However, chapter 2 provides a general literature review across the whole research. In this chapter, consumer 'product choice' in general, 'food choice' in particular, and 'milk choice' in a more specific view are introduced and relevant pieces of literature are reviewed. In the following, the concept of the marketing mix, and several related views are introduced.

A summary of philosophies, approaches, strategies, choices, techniques, and procedures are presented in chapter 3, as the general research design. Also,

methods of data collection and data analysis for each study are briefly demonstrated.

As a consequence of chapters 4, and 5 -each of which deals with one of the studies mentioned- chapter 6 covers the final conclusion. It is not just the summing up of the results of the two studies; it is also the synergy that comes with them.

1.7 Summary

The main purpose of this chapter was primarily to state the necessity of doing this research. The chapter began by introducing the inevitability and importance of the dairy industry, as well as the stakeholders involved in this sector.

The current chapter provided a general introduction related to this research. Although nutritional issues related to milk and dairy products are not the subject of this study, a brief explanation of nutritional necessities was provided, along with an overview of the economic importance of the dairy industry and entrepreneurship opportunities related to this industry. The existence of sufficient agricultural, livestock and processing capacity was then briefly introduced. Moreover, environmental concerns related to the dairy value chain were presented.

After introducing the objectives and contributions of this research, the scope of this research and the outline of the thesis were also defined.

2 LITERATURE REVIEW

"One never notices what has been done; one can only see what remains to be done."

- Marie Curie

2.1 Introduction

This research consists of two interrelated studies. The literature as the basis for the study, as well as research backgrounds used in each of the two studies, are presented in the respective chapters. In this chapter, the generalities associated with the entire research topic as well as examples of previous work in this area are provided and briefly discussed.

The willingness to buy and/or consume any goods (and services) is associated with a variety of motivations and stimuli. While various disciplines, particularly marketing, economics, and behavioral sciences, have studied these factors, and they are not covered, in general; a great deal of the knowledge and efforts of marketing, economic, and behavioral scientists and practitioners are dedicated to identifying the relationships between these factors and their results.

For example, the effects of factors such as price, purchasing power, consumer attitudes, and consumption patterns have been extensively studied in general. The point is how effective each of these factors is. Particularly, the role and importance of each factor for different items are not the same in different societies. This chapter first introduces the factors affecting customers' willingness to buy/consume goods. These considerations are cascaded as follows:

- Product choice,
- Food choice, and
- Milk choice.

Then, by introducing different frameworks of marketing mixes at the end of this chapter, the next chapter will describe the methodology and research design of this research.

2.2 Product choice

Although many factors influence the choice of a product, most of these factors are generally common to a variety of products. These factors have been categorized in various ways by different scholars. For instance, while Lake simplifies these factors into two groups as described in Table 2-1 (Lake, 2009), Kotler and Armstrong categorize them into four groups as described in Table 2-2 (Kotler & Armstrong, 2014).

Table 2-1: The basis of the classification of factors according to Lake

Psychological factors such as:

- Viewpoints
- Beliefs
- Incentives
- Moods

Socio-cultural factors such as:

- Culture
- Consumption patterns
- Demography
- Accessibility
- Availability

Source: Developed for this research based on (Lake, 2009)

Table 2-2: The basis of the classification of factors according to Kotler and Armstrong

Cultural factors	such as:

- Values
- Beliefs
- Customs
- Rituals

Social factors	such as:

- Social class
- Education level
- Family
- Reference groups

Personal factors	such as:

- Age
- Income
- Occupation
- Lifestyle

Psychological factors	such as:

- Perception
- Motivation
- Learning
- Attitudes and beliefs

Source: Developed for this research based on (Kotler & Armstrong, 2014)

On the other hand, while Jain considers economic determinants as a separate group (Jain, 2008), Situational factors have been more important for Tanner and Raymond to be considered as a separate group (Tanner & Raymond, n.d.).

Table 2-3: The basis of the classification of factors according to Jain

Economic determinants such as:
- Income
- Assets
- Credit
- Living standard

Sociological determinants such as:
- Family and reference groups
- Opinion leaders
- Social class
- culture

Psychological determinants such as:
- Perception
- Image
- Personality
- lifestyle

Personal determinants such as:
- Age
- Education
- Occupation
- Family lifesycle

Source: Developed for this research based on (Jain, 2008)

Table 2-4: The basis of the classification of factors according to Tanner and Raymond

Situational factors | such as:

- Place and situation
- Time
- Reasons
- Mood

Personal factors | such as:

- Personality
- Age and gender
- Family structure
- Lifestyle

Psychological factors | such as:

- Motivation
- Perception
- Learning
- Attitude

Societal factors | such as:

- Culture
- Social class
- Reference groups
- Opinion leaders

Source: Developed for this research based on (Tanner & Raymond, n.d.)

As can be seen, most factors are common across contexts and appear with similar names or synonyms across categories. The differences are mostly related to how they are grouped and named.

2.3 Food choice

> "Food security is defined as a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"

<div align="right">(Peng & Berry, 2018, p. 1).</div>

On the other hand, food has a meaning of family, culture, and survival. Therefore, food choice for humans has been more important than product choice in general. As stated by the European Food Information Council, "Food choice refers to how people decide on what to buy and eat" (EUFIC, n.d.-a, p. 1). Food choice has been explained and demonstrated by various models; However, availability, cost, appetite, culture, mood, attitudes, beliefs, and knowledge about food, are among major determinants of food choice (EUFIC, n.d.-b). As illustrated in Figure 2-1, these factors can be categorized into different groups. Figure 2-2, shows that food choice can be affected by a diverse range of factors from several agents.

Figure 2-1 Drivers of food choice

Biological	Economic	Physical	Social	Psychological
•hunger •appetite •taste	•cost •income •availability	•access •education •time	•culture •family •meal patterns	•mood •stress •guilt

Attitudes, beliefs, and knowledge about food
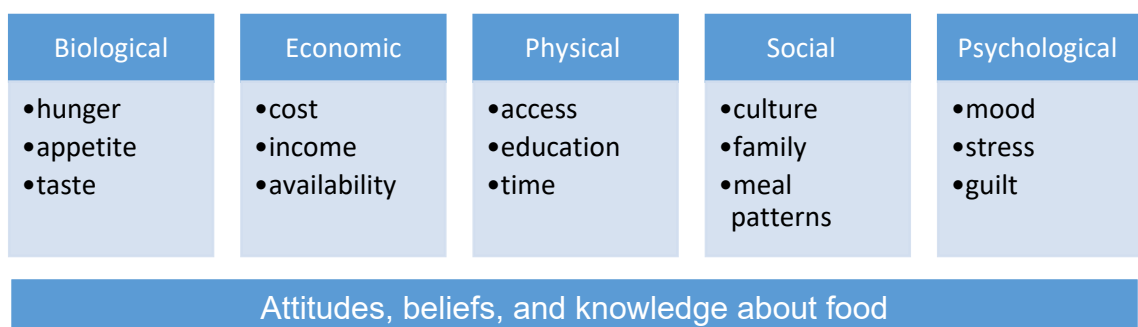
Source: Developed for this research, adopted from The European Food Information Council (EUFIC), based on several sources

Figure 2-2 Diverse range of factors influencing food choice
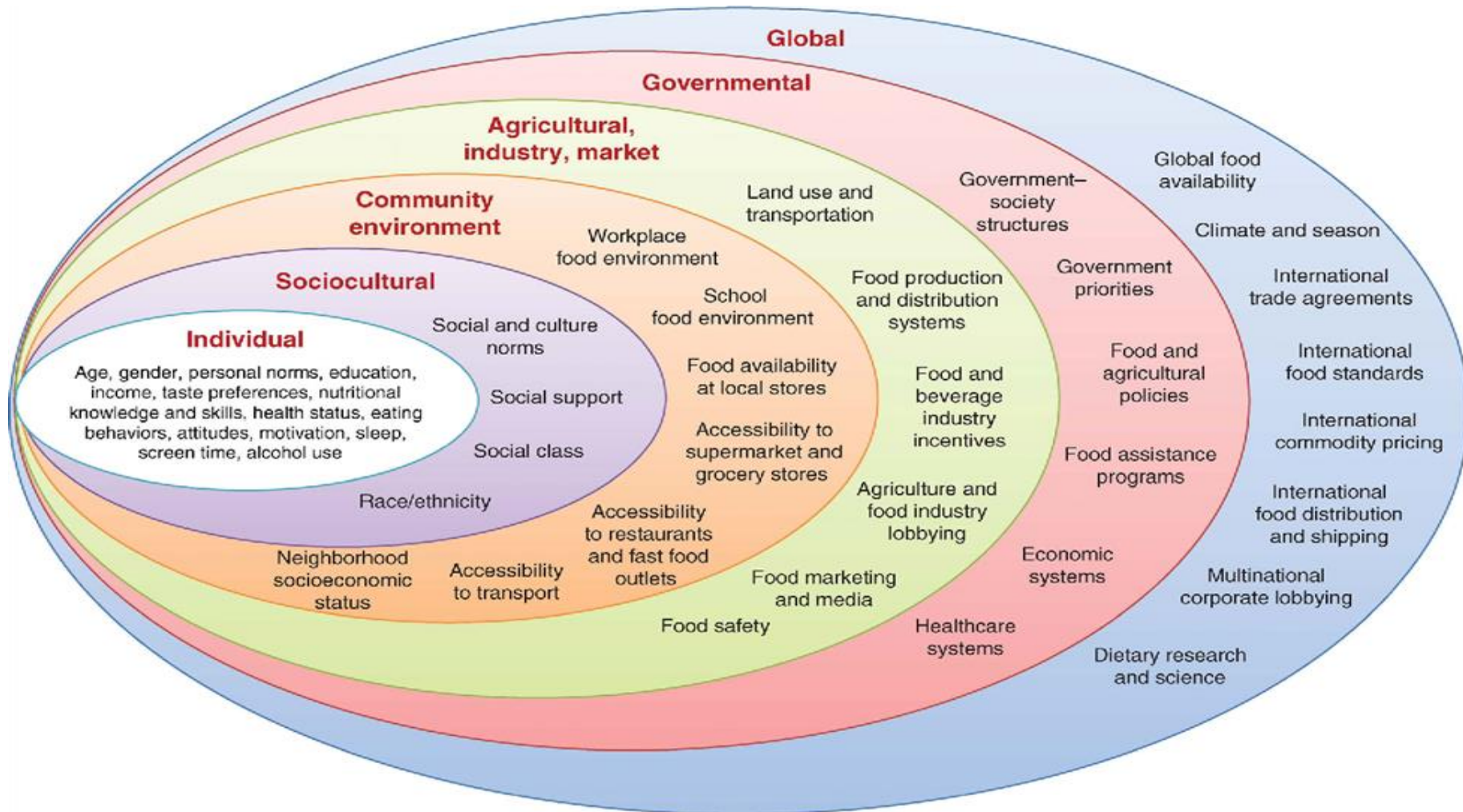
Source: Illustration adopted from (Mozaffarian et al., 2018)

From another point of view, as presented by Kearney:

> "food consumption is variably affected by a whole range of factors including food availability, food accessibility[3], and food choices, which in turn may be influenced by geography, demography, disposable income, socio-economic status, urbanization, globalization, religion, culture, marketing, and consumer attitude"
>
> (Kearney, 2010, p. 2802).

2.4 Milk choice

2.4.1 Micro-level studies

Micro studies are considered here as studies conducted from the marketing perspective to study individuals and households. In contrast, macro studies here are those that have an economic outlook and take into account the whole of society.

All the factors that influence product choice and food choice in general, can also be considered as important factors in milk choice, too. However, some factors such as taste, flavor, packaging, and freshness are more influential in consumers' tendency toward milk and dairy products. *Quality* has a more specific meaning for food, especially for milk and dairy products. Brands also play a great role in this regard.

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[3]- Food availability implies the capacity of a country to provide an appropriate level of food. Food accessibility indicates the physical and economic access of individuals and households to adequate level of foods. Availability and accessibility can be respectively considered as supply and demand sides of food security (FAO, 2008).

There are several studies in this regard. Some have provided models and frameworks; many have tested models or studied communities. For instance:

- Heien and Wessells presented an analysis of the demand for dairy products. Using the Household Food Consumption Survey data, they estimated the structure of dairy product demand. They also classified factors affecting consumption into economic and demographic factors. (Heien & Wessells, 1988).

- According to a study conducted in Malaysia, information such as health benefits, nutritional facts, quality, and perceptions (provided to consumers through brands, certificates, family and friends) determines the purchasing of dairy products (Boniface & Umberger, 2012). This study also showed that location (in terms of availability, position, and cleanness) has a role in purchasing behavior (*ibid.*).

- Milk and dairy products, as very nutritious foods, have limited keeping time and are prone to spoilage. For this reason, milk processing and packaging are a necessity, especially when there is a time and place interval between production and consumption. However, consumers' attitudes toward packed and unpacked fluid milk are not the same. On the other hand, countries with a shortage of milk production, especially South-East Asian countries, address this shortage by importing milk powder. However, consumers' attitudes toward milk powder are different compared to fresh milk. A study in Vietnam examined factors such as brand, advertisement, origin, and their impact on consumers' buying behavior. Age and income influenced buying behavior (Tuan, Phuong, Ngoc, & Mai, 2012).

- Another study in this regard (comparing packed and unpacked milk) and the role of family characteristics were examined in Turkey. In addition to the socioeconomic and demographic factors studied in the Ethiopian case, the size of family and the employment status of the wife were also considered in the case of Turkey (Yayar, 2012).

- Another study in Karachi, Pakistan showed that packaging elements (*e.g.* material, shape, design, color, size, and ease of use) have significant impacts on consumers' buying behavior (Adam & Ali, 2014).

- A study in Ethiopia examined purchasing behavior considering economic factors such as price and income, as well as demographic factors such as age, education, household size and composition (Kuma, Baker, Getnet, & Kassa, 2012).

- Milk consumption in urban and rural households may have different patterns, and consequently, may be affected by different factors, as well. A study of rural households in northern Vietnam, studied their income and composition, along with their demographic data such as age, gender, and education to explore influencing factors on milk purchase (Trung *et al.*, 2014).

- Another study showed that consumers' knowledge and perceptions of milk on appearance, quality, nutritional value, price and convenience matter, and have different importance in urban and non-urban households. (Paraffin, Zindove, & Chimonyo, 2018).

- As a brand-level study in Texas, USA, economic factors (income and price) and demographic factors (age of shopper, age of children, region, race) were examined (Bingham, Dharmasena, Capps, Oral, & Salin, 2014).

- Kumar and Babu examined the role of brand image and advertisement, as well as the price and quality of dairy products on consumer buying behavior in Pondicherry, India. They also considered the variety and availability of products (Kumar & Babu, 2019).

- Although cow's milk has the largest share in the World's milk production (IDF, n.d.), milk from other animals, such as buffalo, sheep, goat, and camel, is also considered in different areas of the earth. Because the nutritional compositions of milk in different animals (as well as their flavor and taste) are different, consumers have different opinions on them. On

the other hand, since the production efficiency of these animals is lower than that of cows, the price of milk they produce will typically be higher. An investigation in Bogor Regency, Indonesia, studied consumers' motivation and perception toward goat milk, as well as their education and occupation, and the role of their reference groups, to predict consumers' interest and factual purchasing (Santoso, Setiadi, Kisworo, & Nuswantara, 2012).

- Lactose-free milk has been introduced for those who have problems with lactose intolerance. A study in Bangkok, Thailand examined the role of health and awareness about the product, its price, and attribute, as well as reputation and communications on the intention of costumers to consume lactose-free milk (Senadisai, Trimetsoon, & Fongsuwan, 2014).

- Despite the fundamental differences in nutritional facts, sometimes soymilk is introduced as an alternative to milk in the market. Demographic and social status studied as key factors of willingness to buy soymilk, as a substitute product for milk (Dharmasena & Capps, 2014).

- Among the innovations in the dairy industry is the production of functional foods to deliver additional function(s) through products. These products are typically supplemented by other ingredients, or enriched by the existing elements. However, there are changes in product prices and features (including changes in color, taste, appearance, and texture) that may not be desirable to the consumer. According to Bazhan *et al.* (2018), barriers to consumption of functional dairy products, are related to (Bazhan, Kalantari, Keshavarz-Mohammadi, Nastaran Hosseini, Eini-Zinab, & Alavi-Majd, 2018):

  1. Consumers (inadequate knowledge, negative attitude, food habits, and taste)
  2. Products (sensory & non-sensory characteristics)
  3. Place of the product
  4. Price (lack of economic access or physical access)
  5. Promotion

- A study by Kurajdová *et al.* (2015) in Slovakia showed that price had no significant role in predicting milk consumption [the results may vary from country to country, even across the level of social classes.]; Whereas, the taste of milk [and other dairy products] can be both motivating and anti-motivating. According to their conclusion, income, age and gender are weak predictors of willingness toward milk (Kurajdová, Táborecká-Petrovičová, & Kaščáková, 2015).

Among several studies presented here, they typically examined the effects of some influencing factors on individual consumers' purchasing behavior, and/or their consumption patterns.

Through empirical studies, generally using questionnaires, such studies consider specific products for a selected group of people. Although the results of such studies are informative and provide insight into consumer behavior, they are limited to the sample studied and are not necessarily generalizable to a larger community. More precisely, they focus on the variability at the level of individuals or households (as parts of society) rather than society itself as a whole.

2.4.2 Macro-level studies

Macro-level studies have received less attention than marketing efforts in consumer studies. For instance, according to the FAO data, the *per capita* milk consumption of countries varies widely around the World (FAO, n.d.-b); however, no quantitative model has yet explained such disparities. Also, according to the FAO, it has been experimentally observed that countries and regions with tropical temperature and humidity, have less milk production (FAO, n.d.-a) and consequently less milk consumption; nevertheless, no model has yet explained the role and impact of these factors. More specifically, there are several counterexamples in this regard that undermine the overall assumption.

On the other hand, countries' milk consumption *per capita* is quite different from their aggregate milk production (considering the population of countries, imports, exports and so on). In particular, no scientific model was found to explain the variability of *per capita* milk consumption <u>between</u> countries. There are studies that have modeled milk consumption <u>within</u> countries. For instance, Dong mentions that dairy consumption growth in the Asian dairy market is decomposed into contributions generated by income growth, population growth, price change, and urbanization (Dong, 2006) following (Heien & Wessells, 1988).

Econometric modeling is a conventional method to predict and/or forecast the trends according to the time series of related data. It is applied to interpret empirical observations and actual data based on economic relationships (Geweke, Horowitz, & Pesaran, 2008). Precisely speaking, Econometrics is a quantitative explanation of observation-based economic phenomena and their description based on existing theories (*ibid.*). Although this method has been used in many economic and non-economic contexts, there are a limited number of econometric analyses investigating milk consumption of one country in particular:

- A study in New Zealand estimated econometric models to evaluate determining factors of milk demand on a quarterly and annual basis (Brodie, Moffitt, & Gough, 1974). They found the econometric modeling as an effective way to predict and also forecast *per-capita* milk consumption. In addition to autoregression to the previous period (AR1), they examined the price of milk, the percentage of population under age 15, and seasonal factors. From this study, disposable income and advertising had not a significant impact on milk consumption (*ibid.*).

- Another econometric modeling in the EU showed that external factors (*i.e.* global supply and demand) are more important predictors of the price for milk and dairy products in the EU, comparing to an internal factor (*i.e.* milk quota regime (Prišenk, Sabljic, Zrakic, & Turk, 2015). The study also mentions the complexity of modeling in the dairy sector, due to the relatively unpredictable nature of agricultural production and its

fundamental dependence on climate changes and weather situations (*ibid.*).

- Through a study in Finland, the relative importance of price for dairy products, together with other substitute and complement goods, and factors such as availability and taste were investigated. It showed that from 1975 to 2010, Along with improving Finland's economy, the consumption of more-processed products (such as cheese and ice cream) has increased; whereas the consumption of less-processed products (such as milk and butter) has declined (Irz & Kuosmanen, 2013). The study also concluded that public health concerns -particularly about high-fat products like butter- have been involved to reduce or change diet in the dairy intake[4]. Another important conclusion of this study was that dairy products have the least elasticity compared to other food products. However, the results suggested that there were important factors that had been neglected in the model; *e.g.* "preference heterogeneity or environmental characteristics" (Irz & Kuosmanen, 2013, p. 55).

- Another study examined milk production in South Africa. Although this research has not been about the dairy market and the factors affecting consumption, it has studied the efficiency of the milk industry using econometric modeling (Mkhabela, 2011).

- Investigating past production and/or consumption trends, and predicting the future, is another usage of econometric methods. The autoregressive model has been used to predict milk consumption in Turkey (Unakıtan, Azabağaoğlu, & Abdikoğlu, 2017). In this study, both current and lagged values of explanatory variables have been used to forecast the future consumption of milk in Turkey.

- Econometrics can also be combined with other techniques and methods to add more value to the research topic. A combination of econometrics

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[4]- Here it should be noted that over the past decade, Finland has always had the highest *per-capita* milk supply in the World.

and simulation modeling along with experimental methods was applied to study price elasticity in New Zealand (Waterlander *et al.*, 2016). The study aimed to examine consumers' responses to changes in food prices so that the results could be considered as taxes and subsidies policies suitable for people's health.

- While a set of factors can affect a variable, the relative importance of each of such factors matter. Another example in this regard is a combination of econometrics and machine-learning concept. This study sought to find a way to compare the relative importance of the variables (Malhotra, 2018). Such results can be helpful in policymaking and decision making.

- Household survey data can be considered as a useful source to estimate food demand. In a study conducted jointly in Argentina, Bolivia, and Paraguay, food demand elasticities were estimated by applying an econometric model (Lema, Brescia, Berges, & Casellas, n.d.). While microdata extracted from household surveys were applied, the approach was a nationwide and inter-national comparison. The study also found that consumption behaviors were distinctly different in the three countries.

There are also other articles that have applied econometric methods for the purposes that are more relevant to a particular product or a particular region. The results of such studies are not mentioned here, as international or nationwide studies have been sought.

In general, no studies were found to explain milk consumption across the World and based on the factors which can be studied within a particular community, and/or between countries.

2.5 Marketing mix

Market behavior is the result of the behaviors of all the agents playing a role in the market (*i.e.* suppliers, producers, service providers, marketers, consumers, policymakers, etc.). In recent decades, the role of consumers has increased as the variety of products and services has dramatically increased and supply has

exceeded demand. While this study is not a marketing issue, understanding market behavior will be helpful. In particular, identifying marketing mixes and applying them to conceptual frameworks will be useful. The marketing mix is by definition:

"The set of marketing tools that the firm uses to pursue its marketing objectives in the target"

(Kotler, 2000, p. 9)

Kotler introduces marketing mixes as 'tools' that are more suited to the 4P's model. There are also other models (*i.e.* 4C's and 4A's) where we can express the marketing mix as 'factors' rather than 'tools'.

This study is not specific to a certain firm or company but covers the entire dairy market. Therefore, the objectives of the entire dairy industry will be in targeting the entire dairy market.

The marketing mix is firstly and mostly considered equivalent to 4P's framework. However, several other models for marketing mix have also been introduced, some of the most common are briefly introduced here:

2.5.1 The 4P's of the marketing mix

4P's framework is considered as the first and still the dominant model for the marketing mix. These 4P's which are Product, Price, Place, and Promotion (McCarthy, 1964) can be considered in line with an organization's marketing strategy to enter/develop the market.

Figure 2-3 The 4P's of the marketing mix

Source: Adopted from *https://yourfreetemplates.com/marketing-mix-template*

In addition to the original 4P's, there are other frameworks such as 7 Ps introducing further elements *-i.e.* Process, People, and Physical evidence- (Booms & Bitner, 1981) and also 8 Ps, by adding Performance to the 7 Ps (Kotler, 2012). 7 Ps and 8 Ps were initially targeted for service marketing.

Figure 2-4 The 8 Ps of the marketing mix

- **Product** includes use, design, packaging, quality, features, colors & size options.
- **Price** depends on packaging (including sizes), discounts, timing, location, shipping & other offer-related elements.
- **Place** includes retail, digital, phone, chat, fax & multi-channel options.
- **Promotion** consists of content, communications & messaging to persuade audience to buy.
- **People** includes everyone your business touches.
- **Principle** means your business must stand for something more than making a profit.
- **Process** focuses on technologies to improve customer experience.
- **Performance** means measurable results aligned with financial & strategic objectives.

Source: Adopted from *https://heidicohen.com/four-ps-of-marketing-mix*

2.5.2 The 4C's of the marketing mix

Product, Price, Place, and Promotion are issues from the perspective of the manufacturer and/or supplier. Such a framework pays less attention to the customer's perspective. To offset this shortcoming, four customer-centric elements were introduced by Lauterborn, which are:

- Consumer's wants and needs
- Consumer's cost
- Convenience to buy
- Communication

(Lauterborn, 1990)

2.5.3 The 4A's of the marketing mix

Another more customer-centric framework to introduce the marketing mix is comprised of Acceptability, Affordability, Accessibility, and Awareness (Sheth & Sisodia, 2011).

The four elements of this model can be considered similar and corresponding to the elements of the 4C's. However, compared to 'Consumer wants and needs' which is more based on the manufacturer's recognition of consumer needs, it can be said that 'Acceptability' focuses more on consumer perception; and in this sense, it is more customer-centric. Likewise, the term 'Awareness' can be compared with and preferred to 'Communication' from a consumer's point of view. While Communication refers more to the means of communication and the method of advertising of the manufacturer; Awareness is about the extent to which consumers perceive a product or service.

Figure 2-5 The 4A's of the marketing mix

Source: Adopted from *https://www.business2community.com/marketing/need-4as-4ps-effective-marketing-01151844*
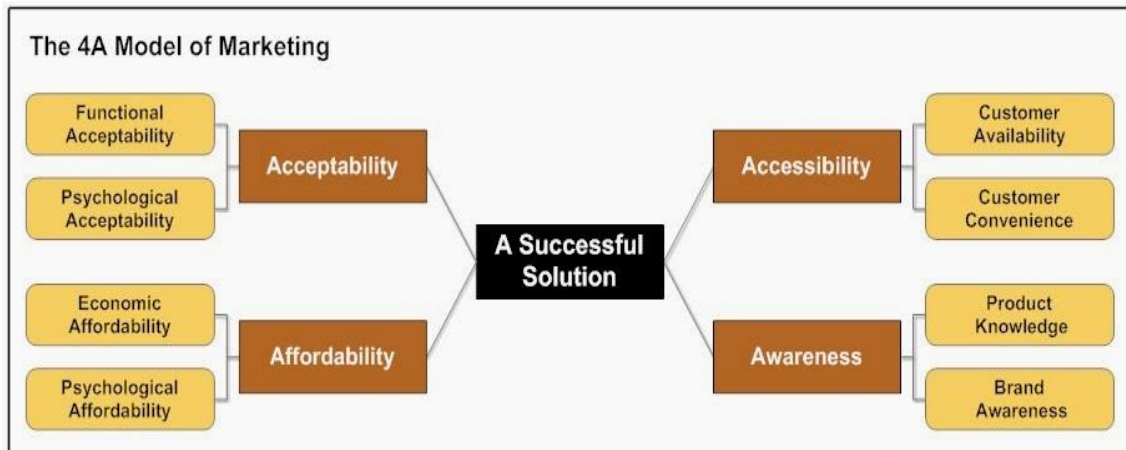
The elements of the 4A framework can also be considered to correspond to the elements of the 4P framework, accordingly (Figure 2-6):

Figure 2-6 The correspondence of 4A with 4P
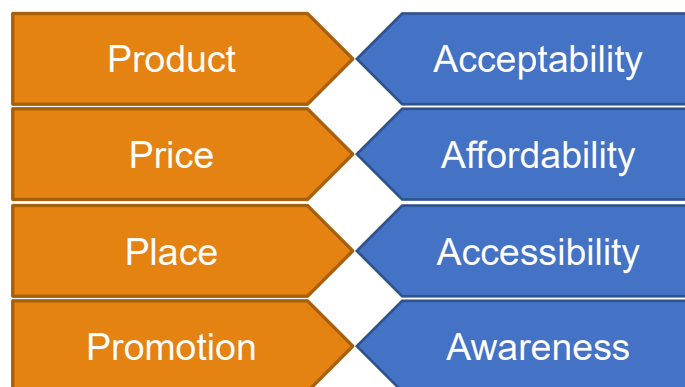
Source: Illustrated for this research

These 4A's together can be considered as the building blocks of strategic marketing management. Also, the relative role and importance of each of them can be studied from the customer's perspective. For instance, in a multi-racial country (*i.e.* Malaysia), research findings show that 'accessibility' situated above 'acceptability', 'awareness', and 'affordability' (Nezakati, Abu, & Toh, 2011). In

this example and for the particular product studied, it is seen that access to the product is of the utmost importance to the customer and/or consumer and should attract the most attention from the supplier.

2.6 Summary

A review of existing literature on factors affecting milk choice shows that most studies have been of a marketing nature and have studied the impact of these factors on a limited group of people in a selected community. Investigating the reasons for the nationwide tendency to buy and/or consume milk and dairy products has not received much attention.

Looking at official FAO data, for example, milk consumption in the eastern hemisphere of the World is typically lower than in the western hemisphere. The same result is seen in the comparison of the southern and northern hemispheres, in general. However, this assumption cannot be accepted as a general principle, due to the existence of numerous counterexamples. More importantly, such perceptions are expressed descriptively, not as a quantitative model. For example, numerical coefficients for the impact of different regions on countries' milk consumption have not yet been determined.

According to the literature reviewed, Availability (in terms of physical Accessibility, plus economic Affordability) plays an important role in consumer orientation, especially in food choice. On the other hand, the product must be Acceptable to the consumer, which in turn is related to consumer Awareness.

In general, compared to the other models mentioned here, the 4A's model was found to be more suitable for studying consumer attitudes toward food consumption. On the other hand, these models are congruent with each other and have much in common with each other conceptually. The difference in how they are introduced can be viewed from the perspective of the observer. While 4P's are seen from the producer or supplier perspective, 4C's and 4A's are seen more from the consumer perspective. The correspondence of the elements of the 4P's with the elements of the 4C's and the 4A's are seen in Figure 2-7. There are

also other frameworks (such as 4O's *i.e.* Objects, Objectives, Organization, and Operations) that are less appropriate for this research.

Figure 2-7 The correspondence of the elements of 4P's, 4C's, and 4A's

4P's		4C's		4A's
Product	⟷	Customer needs	⟷	Acceptability
Price	⟷	Consumer's cost	⟷	Affordability
Place	⟷	Convenience	⟷	Accessibility
Promotion	⟷	Communication	⟷	Awareness
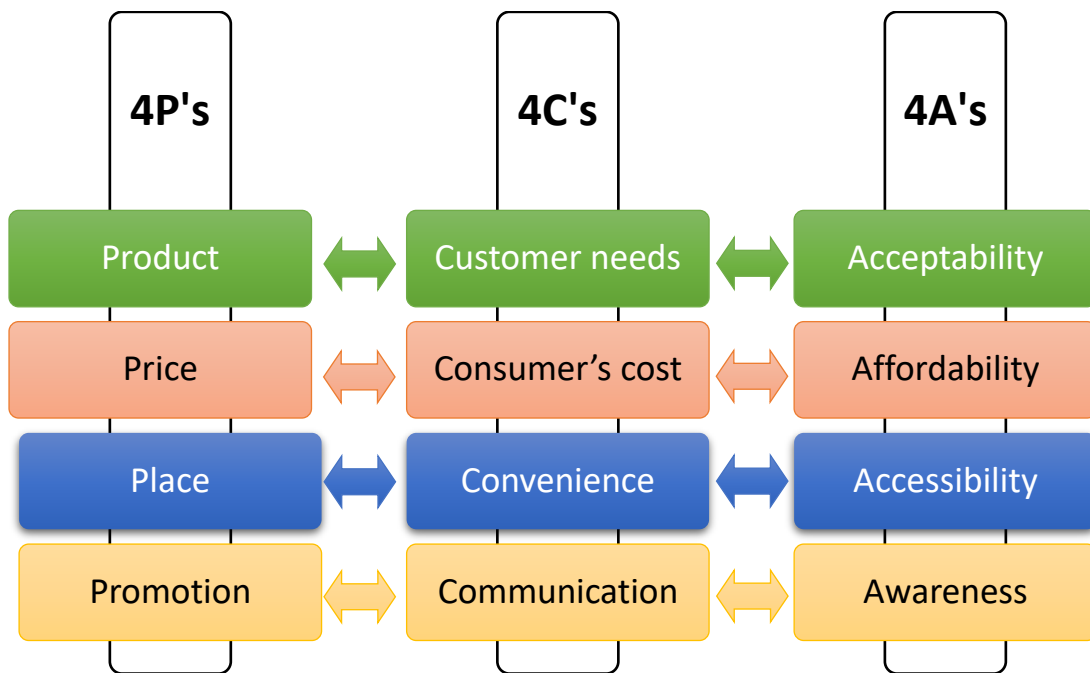
Source: Illustrated for this research

3   RESEARCH DESIGN AND METHODOLOGY

"Intelligence plus character – that is the goal of true education."

- Dr. Martin Luther King Jr.

3.1 Introduction

This chapter presents the research methodology and methods adopted in this research. As described in section 1.5 (Scope of this research), this research consists of two separate but inter-related studies, each with its own literature and design. However, the outline of the research, as well as a summary of the design and methodology of each study, are also presented here to maintain their overall relevance.

3.2 Multidisciplinarity

According to the literature, e.g. (Mozaffarian et al., 2018), there are a long list of factors affecting consumption, in general, and milk consumption, in more detail. These factors, besides being numerous, are also diverse in terms of the field of study.

Even before economic factors such as price and purchasing power (Affordability) come into play, the availability (or Accessibility, as mentioned in this model) of a commodity or food product is essential to determine the amount of demand for that commodity or food product. The availability of a commodity can itself be influenced by many other factors including agricultural capacity, environmental conditions, climate changes, policies, import and export regulations, processing capacities, industry productivity, distribution channels, and many other factors.

On the other hand, assuming adequate food supply, and assuming favorable economic conditions, food should be in line with consumer tastes. In order to food be taken into consideration, it must be compatible with consumer tastes (Acceptability), or consumer tastes must become adapted to food (by providing Awareness). These 4As, discussed earlier in Section 2.5.3 (The 4A's of the marketing mix) and presented as a framework, can be considered as four concepts that influence consumption. However, while these four concepts are combined through a strategic approach, they are not originally developed to measure consumption and cannot be used as a mathematical function. Each of them can be studied and examined through its own relevant measures.

Consequently, in order to gain a more comprehensive insight into the subject under study, one must look at it from different scientific perspectives, namely several different disciplines. Faced with different disciplines, there are two main concerns in line with this research. First, to keep sufficient distinction between the disciplines due to their inherent differences; second, to keep them integrated. As shown in Figure 3-1, different approaches to multi-disciplinary issues, and consequently, to the appropriate methodology can be considered.

Figure 3-1 Schematic difference between various approaches when considering several disciplines

| Intradisciplinary | Multidisciplinary | Cross disciplinary | Interdisciplinary | Transdisciplinary |
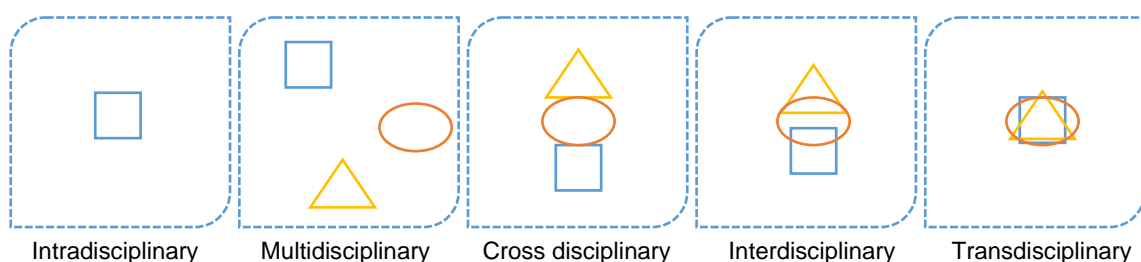
Source: Designed for this research, adopted from
http://www.arj.no/2012/03/12/disciplinarities-2/

Due to the facts discussed in Chapter 2, LITERATURE REVIEW, and considering Figure 1-9, The outline of this thesis, the results of this research are presented through two separate studies. Hence, the multidisciplinary approach was adopted for the research.

3.3 Theoretical framework

According to the background discussed in Chapter 1, GENERAL INTRODUCTION, the phenomenon that has been the focus of this research is the low consumption of milk and dairy products in Iran which leads to malnutrition and diseases associated with malnutrition.

Figure 3-2 The general atmosphere of this research
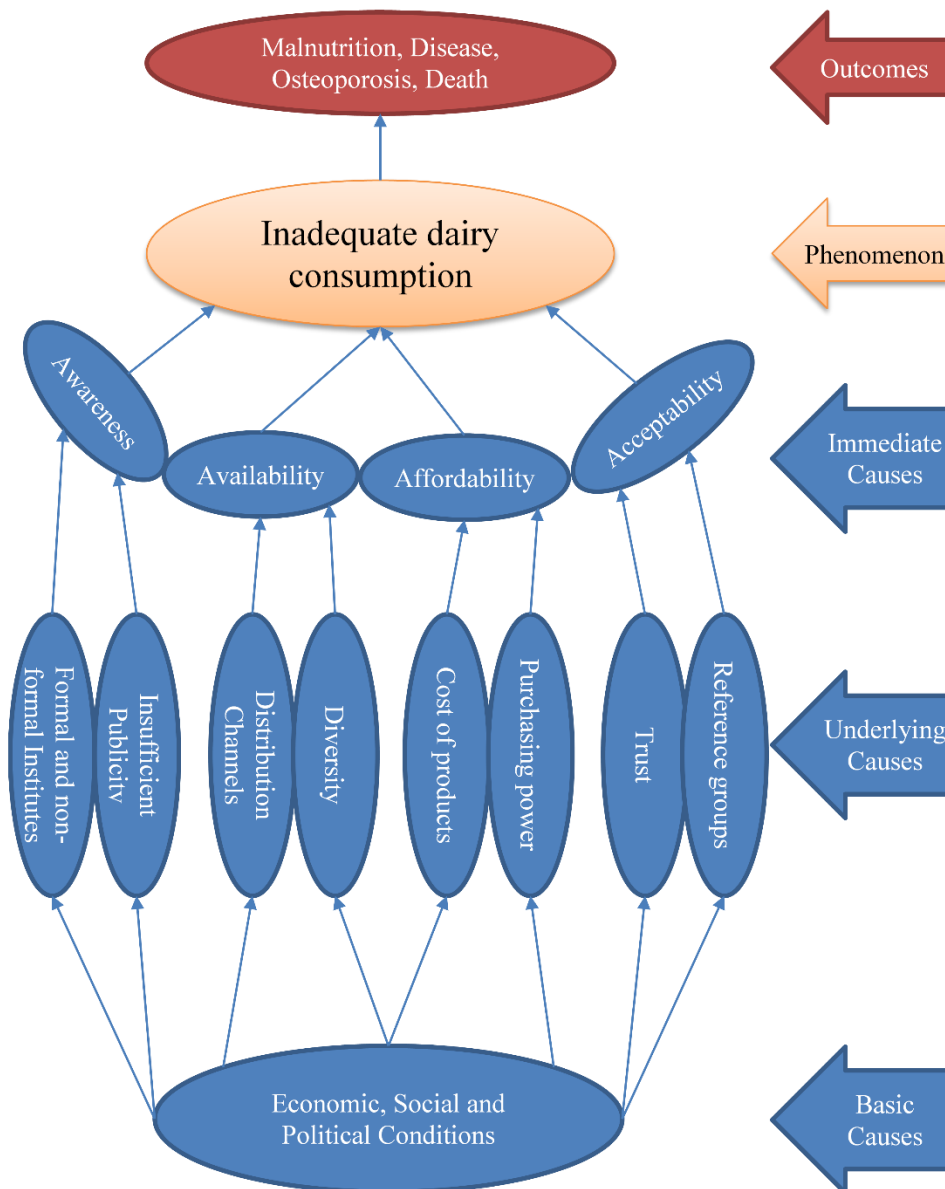
Source: Illustrated for this research

As shown in Figure 3-2, several underlying and basic causes can be considered. However, the immediate causes for low consumption of milk in Iran can be considered as lack and/or shortage of Acceptability, Affordability, Accessibility, and Awareness, which were previously discussed and were chosen as 4A's of the marketing mix for this research.

In this line, a general theoretical framework (Figure 3-3) is considered for this research. Two studies that were previously introduced in Section 1.6, Thesis outline, constitute this research as more explained in Section 3.4, Research design.

Figure 3-3 The general theoretical framework for this research
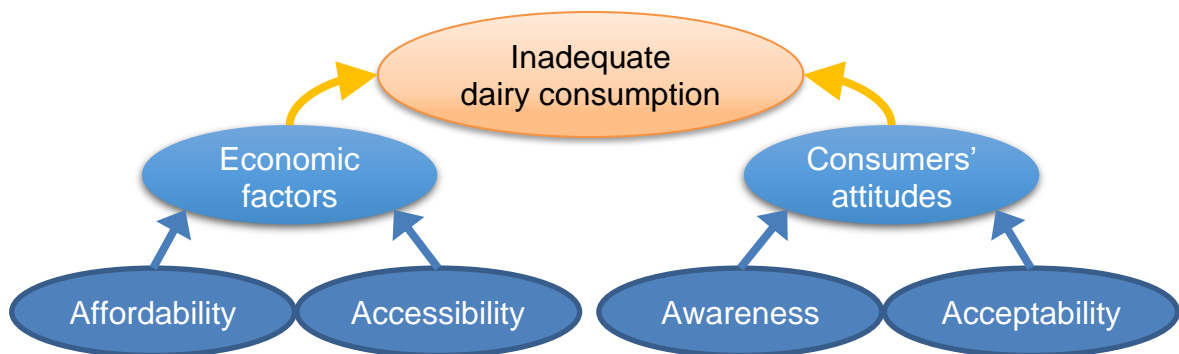
Source: Illustrated for this research

3.4 Research design

As introduced in Section 1.6, Thesis outline, this research is comprised of two studies as follows:

- Study 1 (Chapter 4) is designed to answer this question: Which set of socio-economic or geographic factors can best describe *per capita* milk consumption worldwide? On the other hand, which factor(s) can better explain and predict milk consumption across the World.

- Study 2 (Chapter 5) is designed to investigate the subjective viewpoints of Iranian consumers on milk and dairy products. This chapter will deal with the Acceptability of milk and dairy products in the Iranian dairy market and how Iranian households think about milk and dairy products.

With regard to the 4A's of the marketing mix (Section 2.5.3), these two studies together will provide a multidisciplinary insight into the research topic.

3.5 Research methodologies

The research onion (Figure 3-4) introduced by Saunders *et al.* (2008) is adopted for this research.

Figure 3-4 The research onion
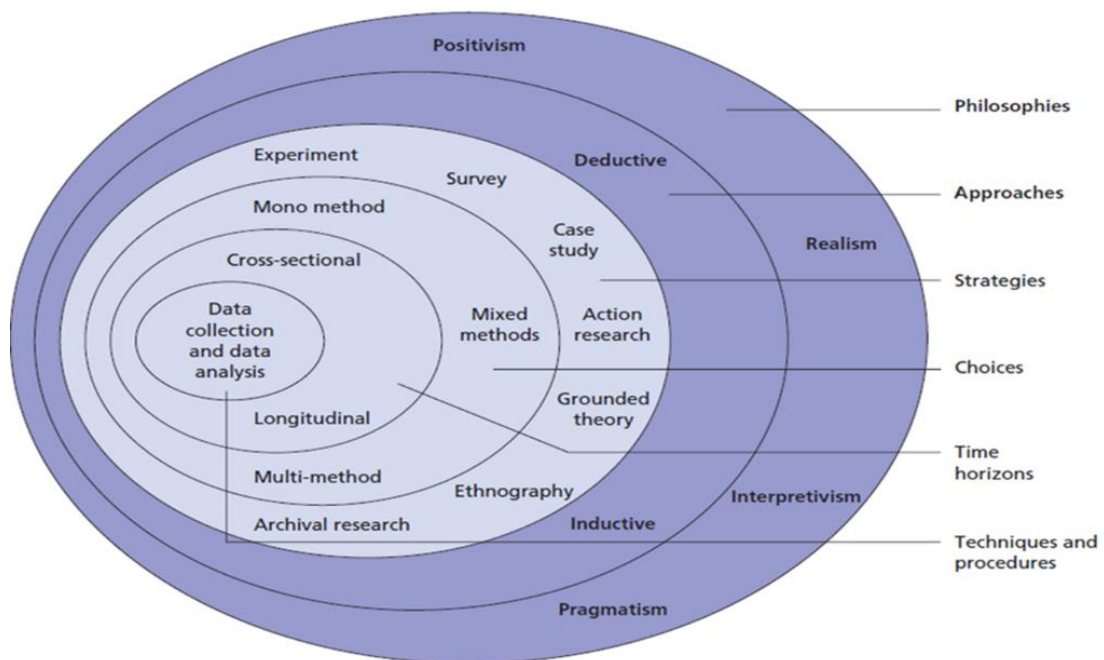
Source: Adopted from (Saunders, Lewis, & Thornhill, 2008)

Philosophies, approaches, strategies, choices, time horizons, techniques, and procedures) are summarized for each of the two studies as the following sections (Sections 3.5.1 - 3.5.7). Each of the two studies may have similarities and/or

dissimilarities in some features, in accordance with the inherent nature of the study itself.

3.5.1 Research philosophies

Table 3-1 Philosophies adopted for each study in this research

Study 1	Study 2
Realism	Interpretivism

3.5.2 Research approaches

Table 3-2 Approaches adopted for each study in this research

Study 1	Study 2
Deductive	Inductive

3.5.3 Research strategies

Table 3-3 Strategies adopted for each study in this research

Study 1	Study 2
Archival Research	Survey

3.5.4 Research choices

Table 3-4 Research choices adopted for each study in this research

Study 1	Study 2
Mono method	Mixed method

3.5.5 Time horizons

Table 3-5 Time horizons for each study in this research

Study 1	Study 2
Cross-sectional	Cross-sectional

3.5.6 Research Techniques

Table 3-6 Research techniques adopted for each study in this research

Study 1	Study 2
Econometric modeling	Q-method

3.5.7 Research Procedures

Table 3-7 Procedures adopted for each study in this research

Study 1	Study 2
• Literature review • Model building • Data collection • Data Preparation • Model examination • Interpretation	• Literature review • Semi-structured deep interview • Concourse • Q-Sample • P-Sample • Q-Sort • Exploratory factor analysis • Interpretation

3.6 Summary

Due to the multidisciplinary nature of this research, it consists of two different studies provided in the next two chapters. Each study has its own methodology specific to the nature of the study. However, a general research design was provided in the current chapter to make the two studies more connected to each other.

First, the theoretical framework for the whole research was presented in the current chapter. Then the overall design, including the two studies were introduced. Finally, research methodologies (including research philosophies, approaches, strategies, choices, time horizons, techniques, and procedures) for the two studies were demonstrated as Table 3-1 to Table 3-7.

4 REGIONAL DIVERSITIES IN MILK CONSUMPTION PATTERNS WORLDWIDE

> *"Geography has made us neighbors. History has made us friends. Economics has made us partners, and necessity has made us allies."*
>
> *- John F. Kennedy*

> *"A good way to do econometrics is to look for good natural experiments and use statistical methods that can tidy up the confounding factors that Nature has not controlled for us."*
>
> *- Daniel McFadden*

4.1 Introduction

Milk and dairy products are among "vital sources of nutrition" (FAO, 2013, p. xii) for billions of people all over the World. In addition to socioeconomic evolutions, in recent years, environmental and nutritional concerns have been raised about livestock products[5]. On the other hand, feeding the World in a healthy and sustainable manner is a critical necessity. Given the fact that the production of any foodstuff has environmental aspects, overconsumption and underconsumption should both be considered as a major concern to sustainable food security.

According to Kearney, the future patterns of consumption suggest that milk consumption will decrease, at least in developed countries (Kearney, 2010)[6]. However, data shows that in some East Asian countries, over the past 50 years,

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[5]- The concerns are more common in European and North American communities, which traditionally consume milk (and also other livestock products) much more than the global averages.

[6]- It should be noted here that the developed countries, as referred to by Kearney, are typically Western countries, which have a *per-capita* milk consumption of at least 200 to more than 300 kilograms *per* year.

per-capita milk consumption has increased by two to ten times (FAO, n.d.-b)[7]. When the large population of such countries is multiplied by their wealth, a great deal of influence in the global economic trends could be expected (Hubacek, Guan, & Barua, 2007). That is why, despite the relatively consistent milk consumption in Western countries, the World average *per-capita* milk consumption increased from 76.8 kg in 1961 to 112.9 kg in 2013. According to the International Dairy Federation, since 2000, milk production has grown by an average of 2.2% *per* year (IDF, n.d.).

4.1.1 Food consumption: necessities and concerns

Achieving sustainable development goals of communities requires sustainable food security programs. Because of uncontrollable factors and parameters, instability should be considered as a natural characteristic of food systems. (Anderson, 2018). A growing population of societies, particularly in developing and less developed countries, will face challenges to improve sustainable food security. "Food consumption patterns and lifestyles heavily affect the environmental sustainability of food production at least in terms of water consumption and greenhouse gas emission" (Benvenuti, De Santis, Santesarti, & Tocca, 2016, p. 704). On the other hand, inappropriate diets of households also lead to malnutrition. "To reduce malnutrition […,] it is hence important to understand food consumption patterns, [and also] to understand how consumption changes over time" (Qaim, 2018, p. 557). Therefore, the World faces two major challenges in the food and agriculture sector: on the one hand, human nutrition needs must be met in the appropriate quantity and quality; on the other hand, natural resources must be sustainably preserved. (FAO, 2015).

4.1.2 Milk: advantages and drawbacks

"Food security is defined as a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food

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[7]- East Asian countries had a very low milk consumption in 50 years ago (typically, less than 10 kilograms *per-capita per* year) due to the Eastern consumption pattern.

that meets their dietary needs and food preferences for an active and healthy life" (Peng & Berry, 2018, p. 1). "Milk is a major source of dietary energy, protein, and fat" (FAO, 2013, p. 43). "It can make a significant contribution to meeting the required nutrient intakes" (FAO, n.d.-f, p. 1).

Despite some concerns mostly related to either extraordinary consumption of processed products (containing fat, salt, sugar, and/or other additives in excess of necessity) or some environmental issues, the nutritive and health requirements of the growing population of the World should be considered and met. "Dairy development is a sustainable, equitable and powerful tool for achieving economic growth, food security and poverty reduction" (FAO, n.d.-a, p. 1).

4.1.3 Economic and market viewpoint

According to the International Dairy Federation (IDF), milk production was estimated at 802.2 million tons in 2014 (IDF, n.d.). By taking into account 7.2 billion World population in 2014 (Haub & Kaneda, 2014), World *per capita per* year milk consumption was reported as 110.7 Kg by IDF. Due to the inevitable losses in the process and transfer stages, the actual milk intake in communities would always be less than its production.

Per capita milk consumption has a great dispersion across countries worldwide. According to FAOSTAT, this amount ranged from less than 4 to more than 400 Kilograms *per capita per* year in 2013 (FAO, n.d.-b). Figure 4-1 shows graphically remarkable differences in milk supply trends through the five continents in the last half-century. According to the same data, such broad ranges of difference can be seen not only between continents but also within continents and regions.

Figure 4-1 *Per capita* milk consumption trend across the World for half a century
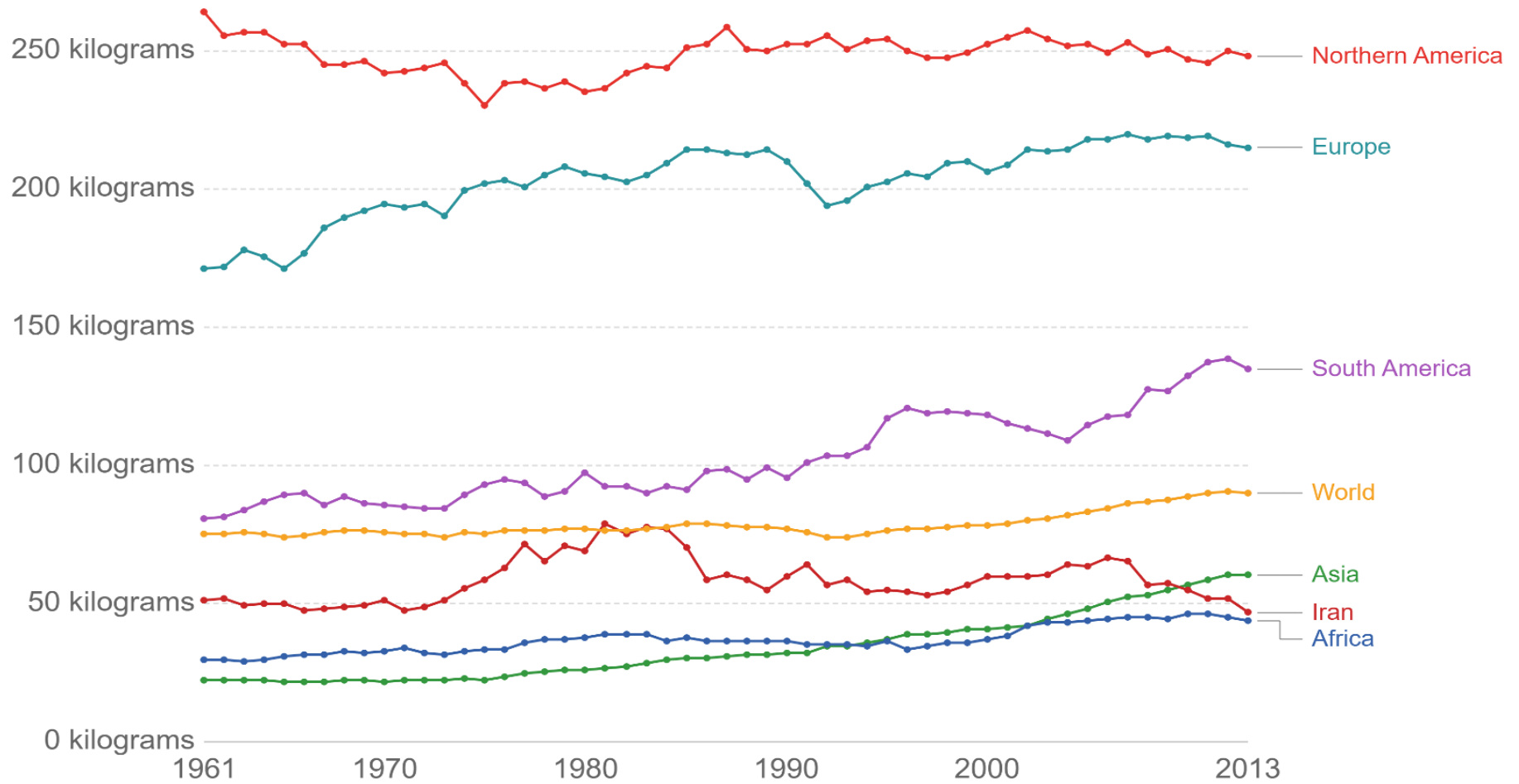
Source: OurWorldData.org adopted from FAOSTAT

4.2 Consumer food choice

4.2.1 The micro and macro viewpoint

Food has a meaning of family, culture, and survival. "We cannot successfully address unsustainable production patterns without acknowledging the consumptive drivers that shape and largely dictate the design of these production systems" (UNEP, 2012, p. 7). Firstly, the difference between the amount of food consumption and the consumer's choice should be here distinguished.

Food consumption, according to the Agricultural Thesaurus and Glossary (the United States Department of Agriculture) is: "Food disappearance data, which measures the flow of raw and processed food commodities through the marketing system" (NAL, n.d., p. 1). Changes in food intake can be attributed to changes in the three factors: population, urbanization, and income. (UNEP, 2012). From another point of view –as presented by Kearney- "food consumption is variably affected by a whole range of factors including food availability, food accessibility[8], and food choices, which in turn may be influenced by geography, demography, disposable income, socio-economic status, urbanization, globalization, religion, culture, marketing, and consumer attitude" (Kearney, 2010, p. 2802).

On the other hand -as stated by the European Food Information Council- "Food choice refers to how people decide on what to buy and eat" (EUFIC, n.d.-a, p. 1). Food choice has been explained and demonstrated by various models; However, availability, cost, appetite, culture, mood, attitudes, beliefs, and knowledge about food, are among major determinants of food choice (EUFIC,

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[8]- Food availability implies the capacity of a country to provide an appropriate level of food. Food accessibility indicates the physical and economic access of individuals and households to adequate level of foods. Availability and accessibility can be respectively considered as supply and demand sides of food security (FAO, 2008).

n.d.-b). As illustrated in Figure 2-2, food choice is affected by a diverse range of factors from several agents.

"Food consumption patterns have [also] changed profoundly over the last 50 years [....] At the same time, malnutrition still exists in many countries of the World as undernutrition, micronutrient deficiencies, overweight, and obesity" (Kearney, 2019, p. 16).

The food that consumers choose can be relevant to the ways they live and to the values they follow. (Van Dam & Fischer, 2015). A particular food might be pleasant for someone, yet unpleasant or even harmful for another. The food that is usually cherished for someone might be disagreeable, insufferable or even allergic to the same one in a different situation, other season or another life stage. (Fischer, 2016). Inadequate food consumption patterns could be considered as one of the major causes of food insecurity and malnutrition. Overnutrition and undernutrition, both can cause health problems, as well as economic issues and environmental impacts. Consumers' food choice, on the other hand mostly relies on their habits (Honkanen, Olsen, & Verplanken, 2005).

We can figure out from the above, that food choice issues can be studied both by taking into account individuals (as diverse preferences in various situations or at different stages of life) and, on the other hand, also by considering the societies (as a matter of culture and social behavior). In this regard, both micro and macro approaches can be distinct.

4.2.2 Differences in milk production and consumption across the World

According to the United Nations Environment Program, World food production at this point in time is sufficient for the World's population (UNEP, 2012). However, the quantity and quality of food throughout the World are not the same. Various countries around the World, as well as households in each country, have varied access to food sources. Such disparities also apply to milk production and consumption.

Diversity in diet and cuisine is quite understandable across countries, between and within societies, and across various segments of customers, as well. Socioeconomic, as well as environmental and climatic conditions, represent the most important influences on availability, accessibility, and affordability of consumers. Acceptability -corresponding to food choice- is more affected by attitudes and habits.

Countries across the World have diverse traditions of milk production and dairy products. The role and importance of milk in the diet are also distinct across societies. For instance, Southeast Asian countries do not have a long tradition of dairy production (FAO, n.d.-a), due to the unfavorable climate. A quite similar situation can be seen in other tropical regions with high temperatures and/or high humidity.

According to the FAO, there is no universally prescribed amount for milk consumption (FAO, n.d.-f). Authorities in many countries, have published National Dietary Guidelines especially developed for their own communities considering both possibilities and necessities. "Because of differences in factors, recommendations vary widely. Most countries recommend at least one serving of milk daily, with some countries recommending up to three servings *per* day" (FAO, n.d.-d, p. 1).

A more detailed look at the FAOSTAT data shows that the average *per capita* milk consumption in the northern hemisphere is higher than the average for countries in the southern hemisphere. Also, such a pattern is seen comparing the western and eastern hemispheres. Obviously, this cannot be considered as a universal fact, due to the existence of numerous counterexamples.

On the other hand, it may seem that richer countries (*i.e.* countries with higher *per capita* GDP) have more milk intake. This supposition can also be criticized due to the existence of several contradictory cases. Another critique may be that the mean values do not reflect the distributions of income. As a result, a statistical model would be worthy to perceive and interpret the situation.

4.3 Literature review

A wide range of factors determines the amounts for demand and supply of any product and service in general (Samuelson & Nordhaus, 2010). When it comes to food products, the multiplicity of factors can be even more diverse (EUFIC, n.d.-b). Consumers' food choice is also affected by several interacting factors (Monteleone *et al.*, 2017). While "Ninety-nine hundredths or, possibly, nine hundred and ninety-nine thousandths of our activity is purely automatic and habitual, from our rising in the morning to our lying down each night" (James, 1899, p. 57) as cited by (Carden & Wood, 2018), the ever-increasing trend of consumer awareness leads to great changes in decision-making styles (Karimi, Papamichail, & Holland, 2015).

The Almost Ideal Demand System (AIDS) introduced by Deaton and Muellbauer is a model to study consumer demand and behavior using the household-level microdata (Deaton & Muellbauer, 1980). To overcome a major estimation problem related to zero consumption of many goods in households' expenditure, Heien and Wessells introduced a censored regression approach (Heien & Wessells, 1990). This approach is still widely used in researches related to demand systems. It generally relies on household food consumption surveys (HFCS) which contain data on food intake and the value of money associated with it. Particularly, analysis of the demand for dairy products presented by Heien and Wessells estimates the structure of dairy products demand and performs prediction interval tests (Heien & Wessells, 1988).

According to Kearney, the drivers for food consumption could be presented as food availability, food accessibility, and food choice (Kearney, 2010). Moreover, food choice itself can also be affected by geography, demography, disposable income, urbanization, globalization, marketing, religion, culture, and consumer attitudes (Kearney, 2010).

On the other hand, subjective elements such as [individual] preferences, [social] influences, [cultural backgrounds,] and psychological or physiological needs (Samuelson & Nordhaus, 2010) are among qualitative concepts that may not be easily measured by quantitative methods.

By summing up all of the above, the factors can be classified into two categories:

1. Factors that cause fundamental differences <u>between</u> countries and communities in the desire to consume certain goods (inherent variables such as geographical, cultural, and religious factors)[9]. It is also well known that habits and behaviors form and transform in the long run through environmental pressures (Carden & Wood, 2018).
2. Factors that cause changes and fluctuations <u>within</u> a community (such as changes in disposable income, and price of food (as well as prices of supplements and substitutes)[10].

Therefore, the factors in the first group will be important to study the differences between countries (which are of interest in this study). Also, it should be noted that the factors in the second group can be studied by chronological time series. Whereas, to study the factors of the first group, one needs to examine cross-sectional data.

When it comes to a nationwide macroeconomic study, factors and variables matter in their aggregate concepts. Hence, for instance, the social desirability of a certain good instead of the individual utility of that good might be of more applicatory.

"The econometrics of aggregation refers to modeling with the individual-aggregate connection in mind, creating a framework where information on individual behavior together with co-movements of aggregates can be used to estimate a consistent econometric model" (Stoker, 2008, p. 55). It could be considered as "the macroanalogue of the microrelations" (Pesaran, 2003, p. 385).

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[9]- Factors such as awareness and urbanization can also lead to major changes in long-term trends.

[10]- Cyberspace and media coverage on scandals, rumors, and health concerns, particularly on food products can also lead to severe fluctuations.

A study in New Zealand estimated econometric models to evaluate determining factors of milk demand on a quarterly and annual basis (Brodie *et al.*, 1974). They found the econometric modeling as an effective way to predict and also forecast *per-capita* milk consumption. In addition to autoregression to the previous period (AR1), they examined the price of milk, the percentage of population under age 15, and seasonal factors. From this study, disposable income and advertising had not a significant impact on milk consumption (*ibid.*).

Consumption Function, in its contemporary methodical definition, was first introduced by John Maynard Keynes in 1936. In its simplest form, the aggregate consumption of a nation or a region can be explained by the aggregate income of the nation or region (Keynes, 1936). With different viewpoints on the type of income (*i.e.*, Current Income, Relative Income, or Permanent Income, respectively introduced by Keynes at 1936, Duesenberry at 1949, and Friedman at 1957), several theories have been raised to illustrate the relationship between consumption and income (Keynes, 1936), (Duesenberry, 1949), and (Friedman, 1957). Although several other variables can also be included and examined in a consumption function particularly modeled for any specific products and services, a term of income is generally observed as a fixed component of such models.

Consumption Function, through a macroeconomic viewpoint, implies all the money, and its share of total income expended to acquire all sorts of different goods and services. To explain the aggregate consumption of a specific product (*e.g.* milk and its products) in a region, a wide range of variables could be examined and investigated. One can even track down the fluctuations of food prices on energy prices (Taghizadeh-Hesary, Rasoulinezhad, & Yoshino, 2019). However, "Economists do not follow the laws of enquiry their methodologies lay down. A good thing, too." (McCloskey, 1983, pp. 481–517).

"Econometrics aims to give empirical content to economic relations for testing economic theories, forecasting, decision making, and for […] decision/policy evaluation" (Geweke *et al.*, 2008) as cited in (Baltagi, 2011, p. 3). Unlike mathematical models, economics literature might involve differences between models and theories (Boland, 1989). While the theories are more abstract, the corresponding models might be more applied or empirical (Greenlaw

& Shapiro, 2017) to test theories. Although many factors can be considered as influential variables in economic relations, in Samuelson's words, several basic concepts can establish the entire economy (Samuelson & Nordhaus, 2010). Hence, testability and availability of the data have been important criteria for modeling an explanatory expression of milk consumption.

The availability of long-term time series reported by official sources has also been a major criterion to choose the most effective likely variables in model construction. On the other hand, testability is a major concern in economic model building (Boland, 1989).

To the author's best search, no studies have been found building an econometric model to explain milk consumption worldwide based on possible explanatory factors.

4.4 Theoretical framework

Theories might seem ambiguous, particularly when examined in diverse situations. Models can be useful to gain more insight into some situations. While the real world is much more complicated, "a model is a small imitation of the real thing" (Sterman, 2002, p. 501). Although "all models are wrong" (Box, 1976, p. 792), some may be helpful in explaining the situation. One major concern in this regard would be the testability (Boland, 1989) of the model over the variables. Another important issue is the availability of constant and reliable data. Finally, the model should be "A good thing, too." (McCloskey, 1983, pp. 481–517) to explain the situation.

As introduced in Figure 2-2, the factors affecting food choice are too numerous and varied to get incorporated into a single model. On the other hand, the effects of these factors are not the same in different societies. Most importantly, reliable and consistent data is not available for all these factors. In practice, no model can contain all the factors. Despite the increasing complexity, numerous variables will not be helpful if they fail to improve the interpretation. From an econometric perspective, we expect a model with fewer variables to have significant explanatory power.

Considering all the influential factors, also taking into account the availability of reliable and consistent data, it seems that categorizing these factors into the three groups referred to by Kearney can cover the theoretical framework of this study. These three groups are food availability, food accessibility, and food choices (Figure 4-2), which in turn may be influenced by geography, demography, disposable income, socio-economic status, urbanization, globalization, religion, culture, marketing, and consumer attitudes (Kearney, 2010).

Figure 4-2 Factors influencing food consumption
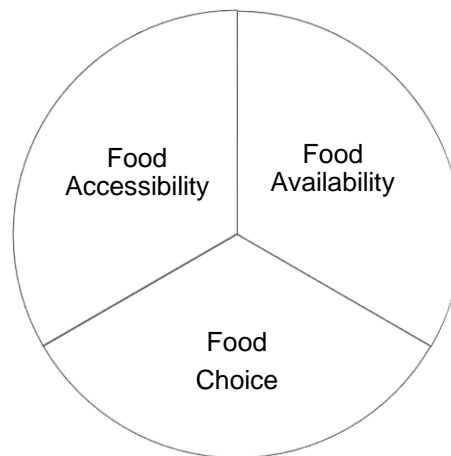
Source: Illustrated for this study, based on (Kearney, 2010)

On the other hand, several foundation models are suggested as the marketing mix, namely 4Ps (Grönroos, 1994), 4Cs (Lauterborn, 1990) and (Shimizu, 1989), together with their extensions as 7Ps, 8Ps, and 7Cs. A comparatively newer approach, "through the eyes of its customers" (Sheth & Sisodia, 2011, p. 4) focuses on "the values that matter most to customers: Acceptability, Affordability, Accessibility, and Awareness" (*ibid*). This latter model, which is called the 4A's of the marketing mix (Figure 4-3), is more compatible both with the influential factors introduced by Kearney and with the inherent nature of Fast-Moving Consumer Goods (FMCGs), such as milk and dairy products.

Figure 4-3 The 4A's of the marketing mix

Source: Illustrated for this study, based on (Sheth & Sisodia, 2011)

An important motivation for choosing and following an applicable theoretical framework would be the availability of data and testability (Boland, 1989) of the model. There are official data for GDP and literacy rate, which -in the absence of any more appropriate data- can respectively be considered as equivalent indicators for 'affordability' and 'awareness'.

'Acceptability' and 'accessibility' are themselves associated to many other factors, including but not limited to beliefs and attitudes, culture and religion, urbanization and globalization, marketing and propagation, habits and behaviors, norms and orders, policies and programs, and most importantly, economic and environmental capacities. Contrary to 'affordability' and 'awareness', for which there are distinct indicators, no explicit gauges are universally published and employed for most of the factors in this list. Such gauges, if any, are not available to all countries across the World.

It can be assumed and examined whether these factors vary from one geographical area to another. Although the type of changes in these factors can be different from each other; a moderator variable can represent the facts

associated with a particular geographical area. Provided being significant, such a nominal variable can distinguish a higher variability between the areas comparing to lower variability within the areas. In this case, it could be interpreted that the geographical location of a country is a significant factor in explaining the tendency toward milk consumption.

On the other hand, by taking into account the income, education, and health status of a given country, Human Development Index (HDI) determines the level of development in the country as a whole (UNDP, n.d.-a). As a reputable international indicator, HDI can be considered as a mediator variable in this regard to acting as a representative for some of the factors.

There could be found a long list of other variables related to the consumption or choice of a specific commodity. However, this is not intended in an efficient econometric model. It is more desirable to build a more robust model with a smaller number of variables. On the whole, a theoretical framework for this study can be simplified as Figure 4-4:

Figure 4-4 Theoretical framework for the study of regional diversities

Source: Illustrated for this research

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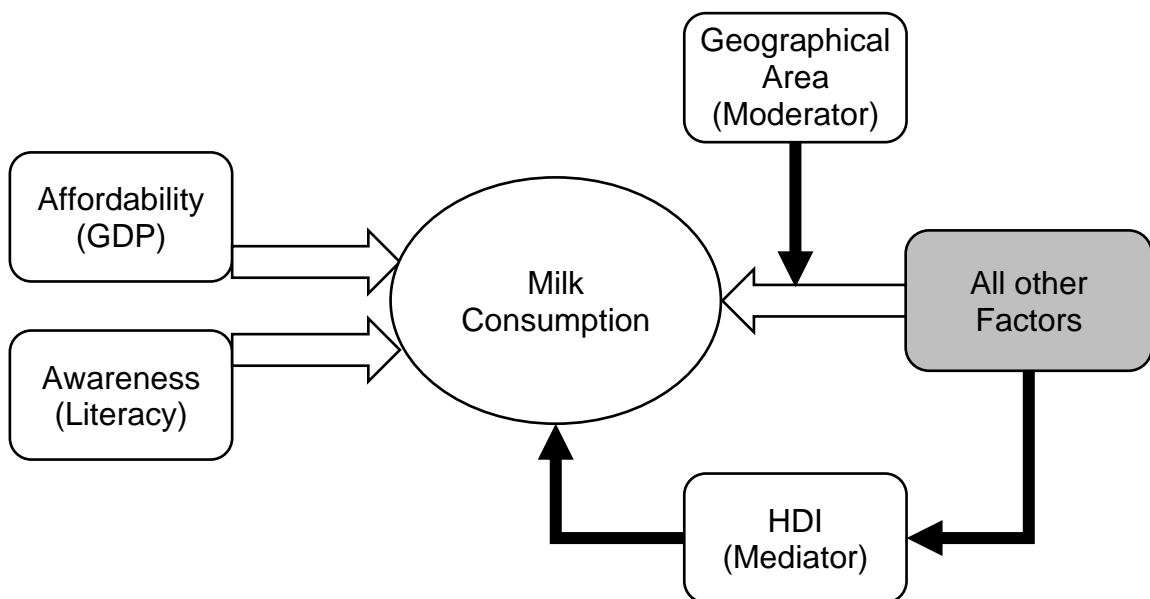
4.5 Definitions, data, and variables

Food choice in general and milk consumption, in particular, can be attributed to factors such as affordability, development, awareness, and culture. In this regard, the most relevant and officially available data were respectively indicated by GDP, HDI, literacy rate, and geographic location. Definitions, data, and variables were considered as follows:

Food supply

Seeking long-term reliable and consistent data for the present study, data related to supply was found more appropriate in this regard. On the other hand, potential demand may exceed actual consumption; while aggregate supply can represent aggregate consumption.

While demand and supply of particular goods are associated with the willingness and ability of consumers and suppliers, respectively (O'Sullivan & Sheffrin, 2003), the following definition which is widely used by FAO for any commodities, implies the concept of aggregate consumption of the certain commodity. According to the FAO, food supply for domestic utilization during a particular time period is defined as (FAO, n.d.-e, p. 1):

"Production + imports - exports + changes in stocks (decrease or increase)"

(4-1)

Since the amounts for imports and exports have been addressed in this expression, the result can be considered as the amount consumed in a given community during a particular time period. Unlike capital assets, milk and dairy products are considered as Fast-Moving Consumer Goods (FMCGs); hence, consumption amount in a specific time period could be considered as equal to the supplied amount.

Average milk supply amounts (including the milk equivalent of all dairy products made from milk ingredients, but excluding butter) in kilograms *per* person *per* year were adopted. While milk (and other dairy products) consumption

differs across a nation or a community, the average amount for milk supply can be assumed as the national milk consumption. The most recent data officially published by the FAOSTAT was related to the year 2013 (FAO, n.d.-b) as presented in Appendix 1 - Data used to investigate regional diversity in milk consumption.

GDP *per capita*, PPP (current international $)

A variety of indicators can be considered as representing national income. As one common indicator -and more importantly, being available for all countries studied- GDP *per capita* for countries was adopted. To be more relevant to consumers' purchasing power, as well as being comparable, GDP *per capita*, PPP (current international $) in 2013 was considered (The World Bank, 2017), as presented in Appendix 1. Due to a wide scope for GDP amounts (ranging from 614 to 140,037), the Logarithm of GDP (to base 10) was also calculated to examine if the transformed variable possesses better explanatory power.

Human development index

"The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone" (UNDP, n.d.-b, p. 1). Human development indices for 2013 (UNDP, n.d.-a) were adopted, as presented in Appendix 1. As seen, HDI ranges from 0 to 1. To examine a plausible correlation between *per capita* milk consumption versus a factor with a wider range, 10 to the power of HDI was also considered in the model.

Literacy rate

The adult literacy rate is a well-known global gauge of literacy among people aged 15 or over. (UNESCO, n.d.-a). The data is published by the UNESCO Institute for Statistics (UIS) which is the official source of this measure. Such data is usually and officially used to observe and conduct education policies and plans (UNESCO, n.d.-b), as presented in Appendix 1. Reported data ranged from

19.1% to 100% in 2013. To investigate any association between *per capita* milk consumption *versus* an agent with a wider range, 10 to the power of Literacy was also considered in the model.

Continents / Regions / Countries

164 countries worldwide -whose data were available in terms of *per capita* milk supply, *per capita* GDP (PPP, current international $), HDI and literacy rate- were considered. Countries were then classified into five groups, namely five continents, and 20 regions (Table 4-1)[11]. The United Nations geoscheme was adopted as the basis of classification (UNSD, n.d.), shown in Figure 4-5.

Table 4-1 Allocated codes to Continents and Regions

Continent	Region	Continent Code	Region Code
Africa		1	
	East Africa		11
	Central Africa		12
	North Africa		13
	Southern Africa		14
	West Africa		15
Americas		2	
	Caribbean		21
	Central America		22
	South America		23
	Northern America		24
Asia		3	
	Central Asia		31
	East Asia		32
	Southeast Asia		33
	South Asia		34
	Western Asia		35
Europe		4	
	Eastern Europe		41

---

[11]- Countries located in Micronesia, Polynesia, and Melanesia, considered as one region.

Continent	Region	Continent Code	Region Code
	Northern Europe		42
	Southern Europe		43
	Western Europe		44
Oceania		5	
	Oceania, Pacific		51
	Oceania, AU-NZ		52

Figure 4-5 Regions of the World as defined by the UNSD

Source: Wikimedia (Wikipedia, n.d.), the free media repository, Information obtained from UNSTAT

4.6 Results and discussion

4.6.1 Plan for analysis

Firstly, descriptive statistics and correlations were calculated. Then, different combinations of factors were examined to set a model describing *per capita* milk supply worldwide. This procedure also categorized regions with similar consumption patterns. Finally, by incorporating dummy variables into the model and using Eviews, submodels were developed to explain milk supply in several regions across the World.

4.6.2 Descriptive results

Table 4-2 and Table 4-3 show that there are remarkable differences between *Per capita* Milk supply, GDP *per capita*, HDI and Literacy rates across the continents and the regions of the World.

Table 4-2 Means of Milk supply, *Per capita* GDP, HDI and Literacy rate across the continents of the World (2013)

Continents	*Per capita* milk supply	*Per capita* GDP	HDI	Literacy rate
Africa	47	4,772	0.48	0.64
America	110	15,872	0.73	0.93
Asia	91	19,515	0.68	0.89
Europe	233	32,264	0.84	0.99
Oceania	73	14,701	0.72	0.79
Total	116	17,731	0.68	0.85

Table 4-3 Means of Milk supply, *Per capita* GDP, HDI and Literacy rate across the regions of the World (2013)

Regions	*Per capita* milk supply	*Per capita* GDP	HDI	Literacy rate
East Africa	38	3,395	0.46	0.71
Central Africa	19	5,377	0.48	0.64
North Africa	105	9,277	0.62	0.73
Southern Africa	66	9,864	0.57	0.86
West Africa	39	2,492	0.42	0.51
Caribbean	92	15,800	0.73	0.92
Central America	97	9,441	0.68	0.88
South America	118	14,186	0.73	0.95
Northern America	185	37,910	0.87	0.97
Central Asia	164	9,694	0.67	1.00
East Asia	76	29,718	0.82	0.97
Southeast Asia	22	16,481	0.64	0.87
South Asia	75	7,265	0.57	0.73
Western Asia	128	28,547	0.74	0.91
Eastern Europe	169	20,190	0.79	0.99
Northern Europe	282	40,778	0.88	0.99
Southern Europe	222	22,338	0.81	0.98
Western Europe	273	54,366	0.90	0.99
Oceania, Pacific	28	4,178	0.64	0.71
Oceania, AU-NZ	186	41,007	0.93	0.99
Total	116	17,731	0.68	0.85

Table 4-4 shows the correlations between factors. It can be seen that Milk supply and HDI were positively and strongly correlated. There was a relatively strong correlation between Milk supply and *Per capita* GDP. On the other hand, HDI itself had a positive correlation with the Literacy rate. All the other correlations between factors were all positive and more or less remarkable.

Table 4-4 Correlations for Milk supply, GDP, HDI and Literacy measures

	Per capita milk supply	*Per capita* GDP	HDI	Literacy rate
Per capita milk supply	1.00			
Per capita GDP	0.61	1.00		
HDI	0.71	0.76	1.00	
Literacy rate	0.54	0.51	0.82	1.00

All correlations were significant at the 0.01 level (2-tailed)

4.6.3 Building the model

Econometric models can be employed to investigate the aggregate milk consumption within countries. In this regard, data were exported to Eviews, to build an econometric model. Meanwhile, some cases were winsorized[12] to get an even more accurate model. Winsorizing is a strategy to deal with outliers. Unlike trimming which simply ignores outlier cases, winsorizing suggests the replacement of outliers by the most extreme retained values (Wilcox, 2005). Cook's distance (Cook, 1977) is a commonly used measure to identify influential outliers (Mendenhall & Sincich, 2012). While this is not guaranteed to correctly identify influential observations (Kim, 2017), it would be worthy to check the cases with large Cook's Distance values (Table 4-5).

Table 4-5 Cases with large Cook's distance values

Record ID	Milk supply (kg/*capita*/yr)	Cook's Distance
101	349	0.105
48	431	0.099
114	183	0.070
2	304	0.054
79	29	0.054
76	288	0.052

---

[12]- Each of the outliers was winsorized in comparison with the nearest case in the same region.

Record ID	Milk supply (kg/*capita*/yr)	Cook's Distance
144	54	0.045
83	174	0.041
139	155	0.034
134	164	0.031
128	148	0.027

By sorting the values of variables from minimum to maximum, it is observed that the changes in HDI and Literacy rate are relatively linear (between zero and one), while the changes in Milk supply is exponential. For this reason, the logarithm of Milk supply was tested instead of Milk supply itself.

4.6.3.1 Dependent variable

Log_MilkSupply (logarithm of *per capita* milk supply)

4.6.3.2 Independent variables

GDP (GDP *per capita*, PPP, current international $)

LIT (the adult literacy rate among people aged 15 or over)

HDI (Human Development index)

Dummy variables are defined as follows:

D11 = 1   If the country is in region 11 (East Africa)
     0   otherwise

D12 = 1   If the country is in region 12 (Central Africa)
     0   otherwise

D13 = 1   If the country is in region 13 (North Africa)
     0   otherwise

D14 = 1   If the country is in region 14 (Southern Africa)
     0   otherwise

D15 = 1   If the country is in region 15 (West Africa)
      0   otherwise

D21 = 1   If the country is in region 21 (Caribbean)
      0   otherwise

D22 = 1   If the country is in region 22 (Central America)
      0   otherwise

D23 = 1   If the country is in region 23 (South America)
      0   otherwise

D24 = 1   If the country is in region 24 (Northern America)
      0   otherwise

D31 = 1   If the country is in region 31 (Central Asia)
      0   otherwise

D32 = 1   If the country is in region 32 (East Asia)
      0   otherwise

D33 = 1   If the country is in region 33 (Southeast Asia)
      0   otherwise

D34 = 1   If the country is in region 34 (South Asia)
      0   otherwise

D35 = 1   If the country is in region 35 (Western Asia)
      0   otherwise

D41 = 1   If the country is in region 41 (Eastern Europe)
      0   otherwise

D42 = 1   If the country is in region 42 (Northern Europe)
      0   otherwise

D43 = 1   If the country is in region 43 (Southern Europe)
      0   otherwise

D44 = 1   If the country is in region 44 (Western Europe)
      0   otherwise

D51 = 1   If the country is in region 51 (Oceania, Pacific)
      0   otherwise

D52 = 1   If the country is in region 52 (Oceania, AU-NZ)
      0   otherwise

The regression of the dependent variable on each independent variable was performed separately to examine their significance. Because of the cross-sectional data, the White correction was considered in the ordinary least squares (OLS) method to deal with heteroscedasticity-consistent (HC) standard errors.

Table 4-6 Results of separate regression of variables

Dependent Variable: LOG_MILKSUPPLY
Method: Least Squares
Sample: 1 164
Included observations: 164
White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Sig.
D11	-0.53	0.13	-3.77	0.000	*
C	1.91	0.038	49.87	0.000	
D12	-0.64	0.07	-9.37	0.000	*
C	1.89	0.03	49.36	0.000	
D13	0.11	0.09	1.16	0.246	
C	1.86	0.03	47.54	0.000	
D14	-0.10	0.10	-1.02	0.306	
C	1.87	0.03	47.75	0.000	
D15	-0.64	0.12	-5.06	0.000	*
C	1.93	0.03	52.74	0.000	
D21	0.06	0.07	0.83	0.406	
C	1.86	0.04	45.62	0.000	
D22	0.08	0.07	1.09	0.277	
C	1.86	0.03	46.95	0.000	
D23	0.16	0.07	2.21	0.028	*
C	1.86	0.04	45.60	0.000	
D24	0.37	0.09	4.01	0.000	*
C	1.86	0.03	48.21	0.000	
D31	0.34	0.05	5.78	0.000	*
C	1.86	0.03	47.60	0.000	
D32	0.00	0.10	0.07	0.936	
C	1.87	0.03	47.62	0.000	
D33	-0.73	0.13	-5.49	0.000	*
C	1.91	0.03	51.73	0.000	
D34	-0.11	0.09	-1.28	0.201	
C	1.87	0.03	47.05	0.000	

D35	0.19	0.08	2.35	0.019	*
C	1.85	0.04	45.25	0.000	
D41	0.37	0.04	8.00	0.000	*
C	1.84	0.03	46.25	0.000	
D42	0.60	0.04	13.79	0.000	*
C	1.83	0.03	47.24	0.000	
D43	0.49	0.04	10.80	0.000	*
C	1.83	0.03	46.21	0.000	
D44	0.60	0.04	13.40	0.000	*
C	1.84	0.03	47.80	0.000	
D51	-0.43	0.13	-3.30	0.001	*
C	1.88	0.03	48.68	0.000	
D52	0.38	0.09	4.23	0.000	*
C	1.86	0.03	48.46	0.000	
GDP	0.00	0.00	6.92	0.000	*
C	1.59	0.05	29.60	0.000	
LIT	1.69	0.22	7.67	0.000	*
C	0.42	0.20	2.07	0.039	
HDI	2.16	0.17	12.47	0.000	*
C	0.39	0.13	2.96	0.003	

As shown in Table 4-6, GDP, HDI, and LIT (literacy rate) seemed statistically significant. On the other hand, it was found that only ten dummy variables (*i.e.* D11, D12, D15, D23, D24, D31, D33, D35, D41, D42, D43, D44, D51, D52) were statistically significant.

4.6.3.3 Model to be estimated
Model (4-2) is presented by combining significant variables:

$$Log\_MilkSupply_i = \beta_0 + \beta_1*D11_i + \beta_2*D12_i + \beta_3*D15_i + \beta_4*D23_i + \beta_5*D24_i$$

$$+ \beta_6*D31_i + \beta_7*D33_i + \beta_8*D35_i + \beta_9*D41_i + \beta_{10}*D42_i$$

$$+ \beta_{11}*D43_i + \beta_{12}*D44_i + \beta_{13}*D51_i + \beta_{14}*D52_i$$

$$+ \beta_{15}*GDP_i + \beta_{16}*LIT_i + \beta_{17}*HDI_i + u_i$$

(4-2)

4.6.3.4 Results

Data on dependent and independent variables in the econometric model (4-2) were analyzed by Eviews 10. The results were as Table 4-7:

Table 4-7 Results for the unrestricted model

Dependent Variable: LOG_MILKSUPPLY
Method: Least Squares
Sample: 1 164
Included observations: 164
White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D11	-0.26	0.13	-1.95	0.052
D12	-0.41	0.09	-4.43	0.000
D15	-0.30	0.16	-1.82	0.069
D23	0.07	0.06	1.07	0.284
D24	0.11	0.06	1.72	0.086
D31	0.31	0.07	4.23	0.000
D33	-0.66	0.11	-5.81	0.000
D35	0.08	0.07	1.05	0.294
D41	0.20	0.05	3.67	0.000
D42	0.29	0.06	4.64	0.000
D43	0.28	0.05	5.52	0.000
D44	0.28	0.07	3.72	0.000
D51	-0.39	0.09	-3.98	0.000
D52	0.07	0.10	0.67	0.497
GDP	0.01	0.00	0.59	0.554
LIT	0.06	0.37	0.16	0.868
HDI	1.01	0.41	2.43	0.015
C	1.13	0.25	4.51	0.000

R-squared	0.74	Mean dependent var	1.87
Adjusted R-squared	0.72	S.D. dependent var	0.48
S.E. of regression	0.2598	Akaike info criterion	0.24
Sum squared resid	9.8549	Schwarz criterion	0.58
Log likelihood	-2.13	Hannan-Quinn criter.	0.38
F-statistic	25.23	Durbin-Watson stat	2.02
Prob(F-statistic)	0.000	Wald F-statistic	51.39
Prob(Wald F-statistic)	0.000		

After eliminating non-significant variables, respectively the least significance, the results were as Table 4-8:

Table 4-8 Results for the restricted (chosen) model

Dependent Variable: LOG_MILKSUPPLY
Method: Least Squares
Sample: 1 164
Included observations: 164
White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D11	-0.27	0.13	-2.08	0.038
D12	-0.42	0.08	-5.10	0.000
D15	-0.31	0.14	-2.10	0.036
D31	0.29	0.05	5.38	0.000
D33	-0.69	0.11	-6.21	0.000
D41	0.16	0.04	3.82	0.000
D42	0.26	0.04	5.16	0.000
D43	0.24	0.03	6.23	0.000
D44	0.25	0.05	4.78	0.000
D51	-0.43	0.09	-4.75	0.000
HDI	1.25	0.23	5.35	0.000
C	1.07	0.17	6.19	0.000

R-squared	0.74	Mean dependent var	1.87
Adjusted R-squared	0.72	S.D. dependent var	0.48
S.E. of regression	0.2564	Akaike info criterion	0.18
Sum squared resid	9.9956	Schwarz criterion	0.41
Log likelihood	-3.29	Hannan-Quinn criter.	0.27
F-statistic	39.83	Durbin-Watson stat	2.02
Prob(F-statistic)	0.000	Wald F-statistic	80.70
Prob(Wald F-statistic)	0.000		

The following hypothesis test was considered to replace the unrestricted model with the restricted model:

H0 : $\beta_4 = \beta_5 = \beta_8 = \beta_{14} = \beta_{15} = \beta_{16} = 0$

H1 : At least one of them is nonzero

The F-test confirmed this substitution as follows:

$$F = \frac{(SSR_R - SSR_U)/g}{SSR_U/(n-k)}$$

$$= \frac{(9.9956 - 9.8549)/6}{9.8549/147}$$

$$= 0.350$$

Given the critical value for F(6,147) = 2.16, α 8549= 0.05, the null hypothesis was not rejected. Hence, the restricted model had been considered as the chosen model. The variables in this model had a joint significant level of explanation, R^2 = .74. Also, the Ramsey RESET test significantly rejected the misspecification of the model, $t(151)$ = 1.16, p>0.25.

Figure 4-6 shows that the model has been able to predict the data. Also, the residuals had a random pattern:

Figure 4-6 Actual, Fitted and Residuals for model 4-3
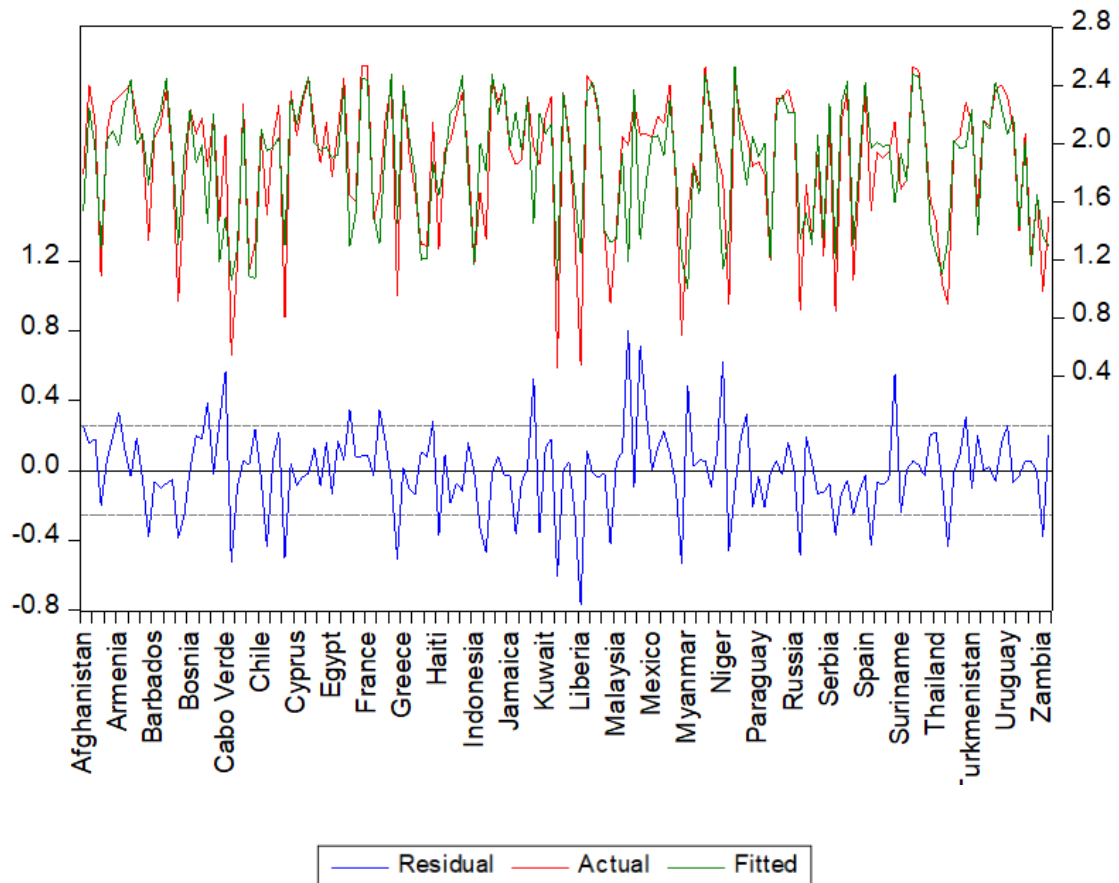
Therefore, the comprehensive model (4-2) can be reduced into model (4-3):

$$Log\_MilkSupply_i = \beta_0 + \beta_1*D11_i + \beta_2*D12_i + \beta_3*D15_i + \beta_6*D31_i + \beta_7*D33_i$$

$$+ \beta_9*D41_i + \beta_{10}*D42_i + \beta_{11}*D43_i + \beta_{12}*D44_i + \beta_{13}*D51_i$$

$$+ \beta_{17}*HDI_i + u_i$$

(4-3)

That is:

$$Log\_MilkSupply_i = 1.07 - 0.27*D11_i - 0.42*D12_i - 0.31*D15_i + 0.29*D31_i$$

$$- 0.69*D33_i + 0.16*D41_i + 0.26*D42_i + 0.24*D43_i$$

$$+ 0.25*D44_i - 0.43*D51_i + 1.25*HDI_i$$

(4-4)

To convert the logarithm of Milk supply, the anti-logarithm of the right-hand expression in the model (4-4) were considered as follows:

$$MilkSupply_i = Antilog\ (1.07 - 0.27*D11_i - 0.42*D12_i - 0.31*D15_i + 0.29*D31_i$$

$$- 0.69*D33_i + 0.16*D41_i + 0.26*D42_i + 0.24*D43_i$$

$$+ 0.25*D44_i - 0.43*D51_i + 1.25*HDI_i)$$

(4-5)

Given the presence of 10 dummy variables, model (4-5) can be rewritten into 11 sub-models in order to predict the milk consumption of the countries in each segment (*i.e.* Regions):

For the region East Africa, D11 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 - 0.27*D11_i + 1.25*HDI_i)$$

<div align="right">**(4-6)**</div>

For the region Central Africa, D12 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 - 0.42*D12_i + 1.25*HDI_i)$$

<div align="right">**(4-7)**</div>

For the region West Africa, D15 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 - 0.31*D15_i + 1.25*HDI_i)$$

<div align="right">**(4-8)**</div>

For the region Central Asia, D31 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 + 0.29*D31_i + 1.25*HDI_i)$$

<div align="right">**(4-9)**</div>

For the region Southeast Asia, D33 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 - 0.69*D33_i + 1.25*HDI_i)$$

<div align="right">**(4-10)**</div>

For the region Eastern Europe, D41 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07\ 0.16*D41_i + 1.25*HDI_i)$$

<div align="right">**(4-11)**</div>

For the region Northern Europe, D42 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 + 0.26*D42_i + 1.25*HDI_i)$$

<div align="right">**(4-12)**</div>

For the region Southern Europe, D43 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 + 0.24*D43_i + 1.25*HDI_i)$$

For the region Western Europe, D44 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 + 0.25*D44_i + 1.25*HDI_i)$$

For the region Oceania, Pacific, D51 = 1, all the other dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 - 0.43*D51_i + 1.25*HDI_i)$$

For all the rest countries in the World, all the dummy variables = 0:

$$MilkSupply_i = Antilog\ (1.07 + 1.25*HDI_i)$$

As a result, with regard to the 10 dummy variables remained in the reduced model, 11 empirical growth curves were obtained. Figure 4-7 explains milk supply patterns in 11 distinct groups of regions in the World. As seen in this figure, they vary both at the starting points (intercepts) and through their exponential growth patterns (slops).

Figure 4-7 Prediction of countries' milk supply in various regions of the World based on their HDI
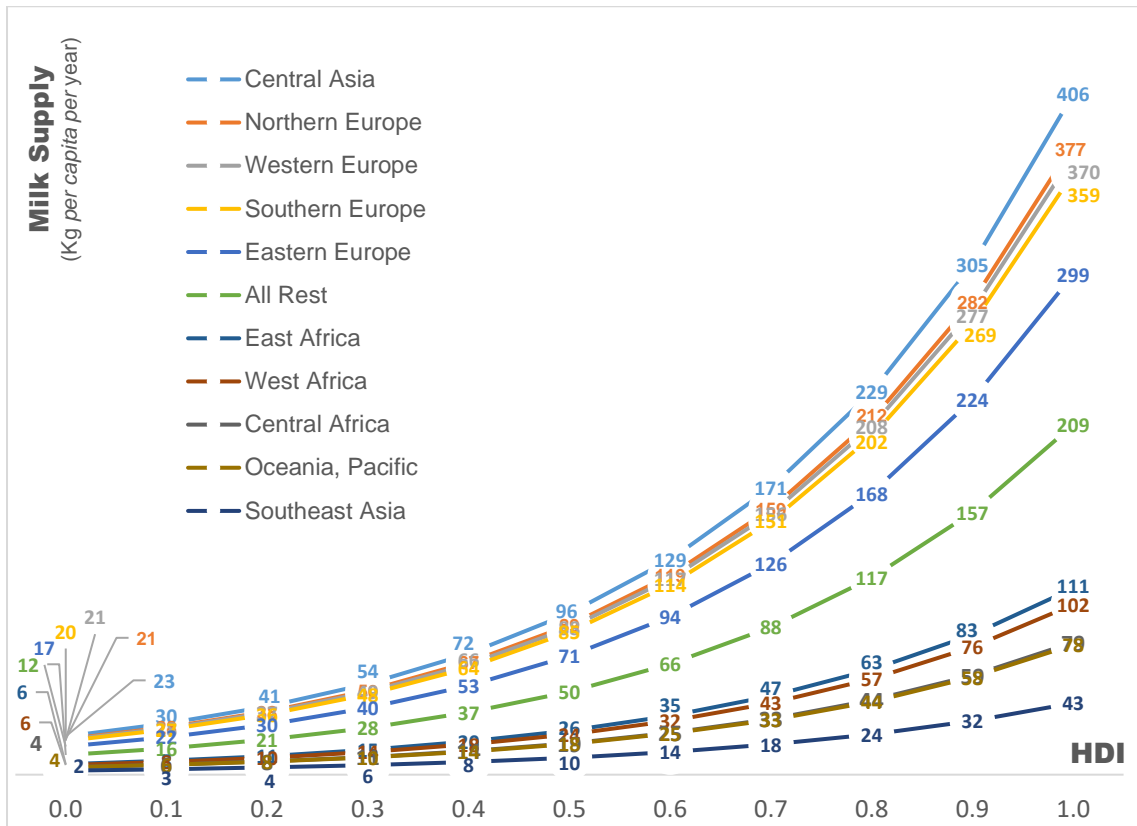
As seen in the data used in this model, HDI ranges from 0.304 to 0.955. Where HDI is 0.3, the starting point for countries' milk supply would be somewhere between 6 to 54 Kilograms *per capita per* year, corresponding to the growth pattern they belong to. The graph clearly shows that the top five regions have more milk consumption than the other countries -with the same HDI. The other five regions have milk consumption less than the global pattern.

Among the five lower groups, Southeast Asian countries have the lowest milk intake, regarding their diet and tradition. The model also suggests that even at the highest HDI level for this region, we cannot expect milk supply amounts much higher than 43 Kilograms *per capita per* year, conditional on all else being equal. All else conditions might include but not limited to remarkable changes in import and/or production capacities, an increase in demand due to awareness-raising interventions, and changes in economic factors such as price and income.

Milk intake in Oceania (Pacific) is quite similar to that of Central Africa (considering HDI). East and West Africa are more or less similar to each other, but slightly above the previous three regions. All these five regions could be considered as low-consumers of milk and dairy products. Low intake of milk in these regions -in addition to being related to their HDI- is more relevant to their geographical area.

On the other hand, five regions have milk consumption tradition above the rest of the World. Central Asia has the highest tradition of milk consumption. Although per capita milk consumption in Central Asia is typically lower than in European countries, the fact can be traced to their lower HDI. If HDI increases, it can be expected that per capita milk consumption in Central Asia will even exceed the European average.

The next three regions, namely Northern Europe, Western Europe, and Southern Europe are next in line and very similar. In terms of milk consumption, Eastern European countries are obviously different from the rest of Europe.

Other countries in the World are in the middle. The per capita consumption of milk in the rest of the World can be predicted in a single group, by considering each countries HDI.

Milk consumptions in North America, Australia, and New Zealand (Oceania, AU-NZ) are typically higher than the global average. However, the coefficient corresponding to this region has not been significant enough to remain in the model. Hence, no separate curve is seen for this area. This reality can be interpreted as saying that higher milk supply in this region can be well explained by their HDI itself.

In general, it can be predicted that as HDI increases, milk consumption will also increase all over the World.

Given that Iran (along with India, Pakistan, and Afghanistan) is located in Southern Asia, we expect milk consumption in Iran to follow the pattern of this region. The dummy variable for Southern Asia was not considered significant in the model. Hence, one should expect that *per* capita milk consumption in Iran

would not be subordinate to a specific geographic area and follow the global pattern. Therefore, according to the equation (4-16) and considering HDI = 0.742 for Iran in 2013:

$Log\_MilkSupply_{Iran} = 1.07 + 1.25*HDI_{Iran}$

$Log\_MilkSupply_{Iran} = 1.07 + 1.25*0.742 = 1.998$

$MilkSupply_{Iran} = Antilog\ (1.998) = 99.54$

$$(4-17)$$

While the model has predicted 99.54 kg of milk consumption for Iran in 2013, the actual amount was 46.7 kg. This remarkable difference indicates that milk consumption in Iran did not follow the regional pattern of similar countries and other factors have also been influencing.

4.7 Conclusion and future directions

People living in different parts of the World experience diverse cultures affecting their consumption patterns. Even in a particular society, socio-economic diversity can affect customers' purchasing behavior and consumers' food choice.

Food consumption in general and milk consumption, in particular, have diverse patterns across the World. Individually, each household and each family member have their own preferences depending to their own needs and wants. On the other hand, a community's aggregate food consumption is affected by a range of factors including food availability, food accessibility and food choices (Kearney, 2010). These two viewpoints -helping us to understand consumers' behavior- are interesting for producers and suppliers of food products. The latter might be more related to governments and policymakers to adopt appropriate nutrition and sustainable development decisions toward societies.

Purchasing power can be considered as one of the major drivers of consumption. There is a relatively strong correlation between *per capita* milk consumption and *per capita* GDP across countries worldwide. However, there

are several contradictory cases: countries with very high income and very low milk intake, and *vice versa*. So, other factors such as availability and food choice seem to be important, too.

As shown in Figure 4-7, there are remarkable differences in milk consumption between continents. With similar HDI, the predicted milk supply in Central Asia and Europe has always been much greater than the global averages.

Food consumption patterns (likewise for milk and dairy products) have long been formed and modified as the following sequences:

1. In the course of history and across the World, just as human beings have used the most available, economical and efficient materials to build their houses, different food consumption patterns have been formed in line with domestically accessible resources.

    For example, tropical regions with high ambient temperatures and/or humidity are not so favorable for dairy farming and that's one reason for low milk supply in Africa, East, and Southeast Asia. Milk availability (as well as capabilities for transportation and trade) have had the main role in cooking traditions and practices, describing cultural differences in these areas. This might boost the use of locally produced milk products at first, and motivate the import/export of raw or processed products to meet the requirements, in the next stages.

2. Habits form and change over time, notably in the long run.

    "Ninety-nine hundredths or, possibly, nine hundred and ninety-nine thousandths of our activity is purely automatic and habitual, from our rising in the morning to our lying down each night" (James, 1899, p. 57).

On the one hand, Any changes in the environment might potentially lead to changes in some habits (Carden & Wood, 2018). Nevertheless, it should also be noted that certain interventions can transform habits (Wood, 2017).

So, strongly formed habits might change in the long run, if factors affecting change are consistently present.

3. The facilitation of communication over time has created food diversification for nations and communities. Urbanization and globalization have been the two major factors in this regard (Kearney, 2010)[13].

   Milk supply trends in the last 50 years show that in many East-Asian countries, milk consumption patterns have been rising (FAO, n.d.-b), coordinated with their industrial development as well as their increasing urbanized and globalized culture. Comparing milk supply between South Korea and North Korea in 2013 (29.1 compared to 3.8 Kg/capita/year, despite the similar climate and culture) supports this idea. Another example is comparing Hong Kong and China mainland (106 compared to 33 Kg/capita/year). In general, trends in milk consumption in China, Japan, and other Far-East Asian countries -with traditionally low milk intake- shows that they have had the greatest growth rate in the last fifty years, along with their economic development.

4. It is quite reasonable that any growth in income could potentially improve a more profitable diet. However, according to the FAO (FAO, n.d.-e), this depends on the consumer's awareness of the need for good nutrition; otherwise, additional income may only result in more purchases of similar foods and even less nutritious foods. Economic factors (*i.e.* price and purchasing power) could be considered as boosting factors rather than initial triggers. Following the cultural change, improving economic conditions is an important factor in increasing desirability for milk consumption. This fact can be contemplated in almost all East-Asian countries and most of the South American countries. Some of these countries have a huge impact on the global average of milk consumption because of their large population. In this regard, the fastest growth is seen in Asia and South America (Figure 4-1).

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[13]- It should be noted here that no official data was found to address globalization or urbanization indices for the whole countries studied.

5. A growing awareness of nutrition issues gradually affects food consumption patterns toward healthier food choices. On the other hand, habits, along with economic barriers tend to resist such changes. Despite the fact that in recent decades dairy consumption (in particular, drinking milk) has been modestly reduced in developed countries. (Zingone, Bucci, Iovino, & Ciacci, 2017) and (Harwood & Drake, 2018); incremental slopes can be seen in developing countries (FAO, n.d.-b).

6. With increasing globalization, fewer differences and more similarities between nations and communities are expected. This is what really happening, not only toward food choices but also in the case of cultures and languages.

7. Plain milk as the less complicated and less expensive dairy product could be consumed to a certain extent in daily food intake. The tendency toward consumption over that amount, along with food safety requirements associated with durability, storage, and transportation, as well as new product development, needs extra and supplementary processes and practices which will lead to increased costs and expenses. One sensible reason for such differences between countries could be tracked in the diversity of products. That's why in high-income countries, cheese and ice cream consumption is on the rise and liquid-milk consumption is on the decline (Irz & Kuosmanen, 2013).

8. Transition in demographics and lifestyle is another factor affecting the type of desirable dairy products. Despite the increase in milk consumption over the past decades, the relative share of whole milk consumption in dairy products has dropped. The development of new technologies as well as new products has led to an increase in the diversification of dairy products (Barbano, 2017).

9. Human Development Index (HDI) is a three-dimensional composite index of a nation's achievements in the areas of health, education, and income. Being correlated to many other factors, HDI as a single factor was quite significant to explain the amount of milk supply across the World.

However, each country had its own growth curve, corresponding to its geographical area (Figure 4-7).

10. Milk-supply growing curves had an exponential nature, implying that even slight increases in HDI would lead to large increases in milk consumption (Figure 4-7). In particular, this reality will be interesting for policymakers.

From the model and findings, it could be concluded that the moderator variable - presenting the geographical area- can specify where the differences in milk consumption occur. On the other hand, the mediator variable (HDI) specifies how such differences happen.

Building a model based on existing variables shows that geographic location plays the most important role in this model. It can be concluded that among the studied factors, the place of birth and growth forms the primitive and principal core of consumption patterns. HDI, and consequently literacy and income (as secondary factors) have respectively a directing and boosting roles. In the same way, urbanization and globalization (as tertiary factors) have a facilitating role. By increasing public awareness and personal incomes, these latter factors (urbanization and globalization) might affect the intention to increase the consumption of healthier foods. It is worth noting that income and awareness must be provided along with each other; unless, additional income might only result in more purchases of similar foods and even less nutritious foods (FAO, n.d.-f).

It is worth noting and emphasizing that diverse groups of consumers have various nutritional needs at different stages of their lives. In this sense, *per capita* milk consumption as an average for nations, should not be considered as a representative amount for individuals. However, a comparison of average milk supply by countries, as well as observing milk consumption trends in a given country can indicate the economic development of countries. On the other hand, "milk industry is one of the driving forces and opportunities for the economic development of a given country, especially in terms of increasing employment and entrepreneurship opportunities, increasing national production, improving health status of the community, as well as reducing the complications and

deficiencies caused by the low consumption of milk and dairy products" (Ajorloo, 2017, p. 9). For all these reasons, the amount of milk supply in a country could be considered as an indication of economic development, social status, health, and well-being states.

"Attitudes are in fact important predictors of intention and behavior [; however,] this appears often not the case when strong habits have been formed" (Honkanen et al., 2005, p. 166). Consumers' attitude plays a great role in their intention for milk consumption. Following this study, in the future studies on consumer behavior and with respect to different consumer choices, it will be worthy to study and understand diverse attitudes toward milk in different regions across the World. Also, it will be worthwhile for future studies, to examine the role of awareness against habits.

5 The Perspectives of Iranians on Milk and Dairy Products

"I don't think anything changes until ideas change."

- James Hillman

5.1 Introduction

Milk is one of the main sources of nutrition, especially in providing calcium, protein and other nutrients (FAO, n.d.-f). A daily intake of two to three servings of milk or equivalent amount of other dairy products is advised by nutritionists and Iranian health authorities (MOHME, n.d.) as cited in (WHO, n.d.) and (FAO, n.d.-c), too. However, *per-capita* milk intake in Iran has always been much lower than recommended amounts as well as the global average (FAO, n.d.-b).

Apart from economic factors such as price and purchasing power, consumers' willingness toward food products could be related to a vast variety of other factors (Kearney, 2019), (EUFIC, n.d.-a), (EUFIC, n.d.-b), and (UNEP, 2012). For milk, in particular, there are several reviews investigating influential factors (Kurajdová & Táborecka-Petrovicova, 2015). In addition to environmental factors (*e.g.* cultural and social patterns), personal perceptions and misperceptions have a great role in milk consumption.

Zaltman believes that "95 *percent* of thinking takes place in our unconscious minds" (Zaltman, 2003, p. 2). Contrary to some theories that consider an intrinsic nature for *value* (Zimmerman, 2001), the contemporary adaptation of the *subjective theory of value* suggests that a certain *item* might be differently valued by different individuals, depending to the importance they might place on the same *item* (Menger, 2007).

A diverse range of both qualitative and quantitative methods and tools can be employed to study the consumers' viewpoints on certain topics. However, there are advantages and drawbacks to each of them, taking into account the context of the study. Perspectives can vary dramatically from the intrapersonal to the intercultural (Brown, 2019). One major issue is that viewpoints have a subjective nature, and subjectivity cannot be thoroughly evaluated by objective tools.

"Subjectivity is ubiquitous" (Brown, 2019, p. 565). Contrary to the objective phenomena that are "not dependent on the mind for existence" ("Oxford Living Dictionaries," n.d.-a), subjective concepts are strongly "influenced by personal feelings, tastes, or opinions" ("Oxford Living Dictionaries," n.d.-b). As Stephenson puts in Q-methodology, subjectivity implies the viewpoint of a person (Good, 2010). There are different approaches to study and/or to examine self-reference issues. Stephenson was the first to employ "a mathematical-statistical key" in Q methodology, to recognize the significance of self-reference (Stephenson, 1994, p. 2). For the most part, subjective perceptions are implicit and effortless cognitions that come from everyday life experiences, and not necessarily from educational programs (Stephenson, 1980) or promotional programs.

Modern science has come to the conclusion that the measurement procedure should be as close as possible to the subject (Stephenson, 1994). While in the course of interviews, questionnaires, and focus groups, interviewees are subject to the influence of researchers and measurement tools; Q methodology makes sure that "self-reference is preserved and not compromised or confused by external investigation" (McKeown & Thomas, 2013, p. xvii). As "subjective points of view are communicable and always advanced from a position of self-reference" (McKeown & Thomas, 2013, p. xvii), Q technique can be employed as "a radically new approach to the study of human behavior" (Good, 2010, p. 215).

5.2 Method

5.2.1 Q-methodology

While people might have a diverse range of viewpoints toward a given topic, Q methodology is a scientific way, firstly, to extract such a variety of perspectives, and secondly, to appoint individuals to the extracted viewpoints.

Correlating Persons Instead of Tests (Stephenson, 1935) should be considered as the initial impression of the idea, which later evolved by William Stephenson as *The study of behavior; Q-technique and its methodology* (Stephenson, 1953). This was the first book to introduce the principles of Q-methodology (Good, 2010). In short, Q-methodology is the deployment of Factor Analysis to study human subjectivity (Brown, 2006). While measuring people's subjectivity is challenging and error-prone (Widaman, n.d.), the Q method is a systematic effort to discover the variety of qualitative perspectives.

Figure 5-1 Extracting distinct perspectives using Q methodology
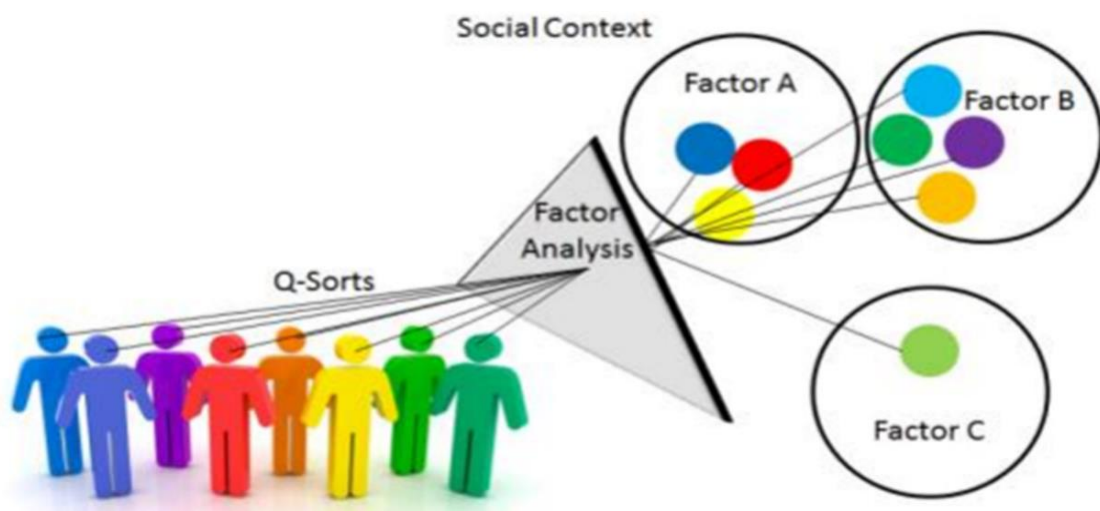
Source: adopted from (O'Leary, Wobbrock, & Riskin, 2013)

The researcher of a Q study has the least influence on the interviewees (Brown, 2006), who are called participants in this methodology due to their constructive role and bold part. The concourse and the statements derived from it are directly

or indirectly gathered from the society or community. They are also solely sorted by the participants. The researcher plays the role of facilitator, which would then be followed up by the task of statistical analysis.

The name Q has been chosen in opposition to R. Ordinary factor analysis (R) results from correlation probe between variables across the cases. Conversely, Q checks the correlation between cases (*i.e.* subjects) across the variables. In R-methodology, persons are cases with some traits as variables; In Q-methodology, however, persons are considered as variables (Good, 2010).

While customary utilization of factor analysis is to reduce the dimensionality of variables -so that meaningful factors can be extracted as features- Q methodology applies this quantitative possibility to extract meaningful viewpoints from qualitative data.

One of the important features of this methodology is that it is a combination of psychometric principles with statistical applications which provides a "systematic and rigorously quantitative means for examining human subjectivity" (McKeown & Thomas, 2013, p. xvii).

Q methodology actively involves participants with a set of statements. They are being asked to sort the statements based on their opinion and through the instruction they are provided with. Q-sorting is a task to prioritize different opinions (from the least agreed to the most agreed). Since the statements only express opinions -not factual information- in this method, the 'right' or 'wrong' is not considered (Brown, 2006); rather, the relative arrangement of statements is more intended. Different arrangements by participants indicate the diversity of viewpoints. Factor analysis is the technique to reveal the correlation between participants, as suggested by Stephenson. In this sense, Q can be considered as a way of segmentation (*i.e.* detection of diverse viewpoints).

While Q methodology has a qualitative nature both in collecting initial data and interpreting the final results; and while the focus is on quality rather than quantity (Brown, 2006); the investigation technically relies on exploratory factor analysis. In this regard, Q is considered as a mixed-method approach. Raw data for this method can be provided from other methods (*e.g.* results from interviews

or surveys) (Rastogi, Hickey, Badola, & Hussain, 2013) and (Hagan & Williams, 2016) as cited in (Zabala, Sandbrook, & Mukherjee, 2018).

Because the procedure is separately conducted for each individual, participants are not psychologically affected by others -as they might be in focus groups. On the other hand, since participants are not directly interviewed, they are less influenced by the interviewer or environmental conditions. The participants do not just passively respond to predefined questions; rather, they actively participate in the concourse formation, and consequently, they shape the factors by sorting the statements. The researchers are not just observers or evaluators; they have an active role in facilitating the procedure, and they subsequently interpret the factors.

While, according to the literature review, this technique has mostly been applied to psychology, communication, health, environmental, and political science areas (Brown, 1993), the application of this methodology can be extended to any other study in line with understanding human perspectives (Zabala *et al.*, 2018).

5.2.2 Strengths and limitations

A great privilege of Q methodology is that, through quantitative analysis, it transforms qualitative data into qualitative results. While every quantitative and qualitative research method has certain advantages and disadvantages, Q benefits from both approaches. Particularly compared to other social research methods, Q has four distinct attributes (Zabala *et al.*, 2018):

1. The perspectives are interpreted according to numerical results.

2. Contrary to popular surveys, in Q, participants evaluate the statements in a comparative way.

3. Unlike ordinary factor analysis, in which dimension reduction is applied to variables; the same technique is applied in Q to consider the resemblance between participants, rather than variables.

4. As needed to be sorted in a relative way, statements are less exposed to bias.

There are also two main issues which should be considered in this regard:

- The ratio of people belonging to identified viewpoints cannot be generalized to society. Basically, Q does not seek this objective. The intention is just to discover different perspectives.

- There is no guarantee that all the viewpoints are assuredly discovered. However, usually, there are a limited number of viewpoints for any topic (Brown, 1993)

Compared to methods such as the questionnaire, the interaction with participants in the Q method takes more time. Also, participants will usually need to receive instructions on how to proceed with the sorting.

5.2.3 Procedure

Q studies are usually conducted through the stages introduced by Brown and subsequently by Van Exel and Graaf (Brown, 1993) and (Exel & Graaf, 2005) as cited in (Hagan & Williams, 2016). A conceptual framework for a Q study can be summarized in Figure 5-2:

Figure 5-2 Common steps in a Q study
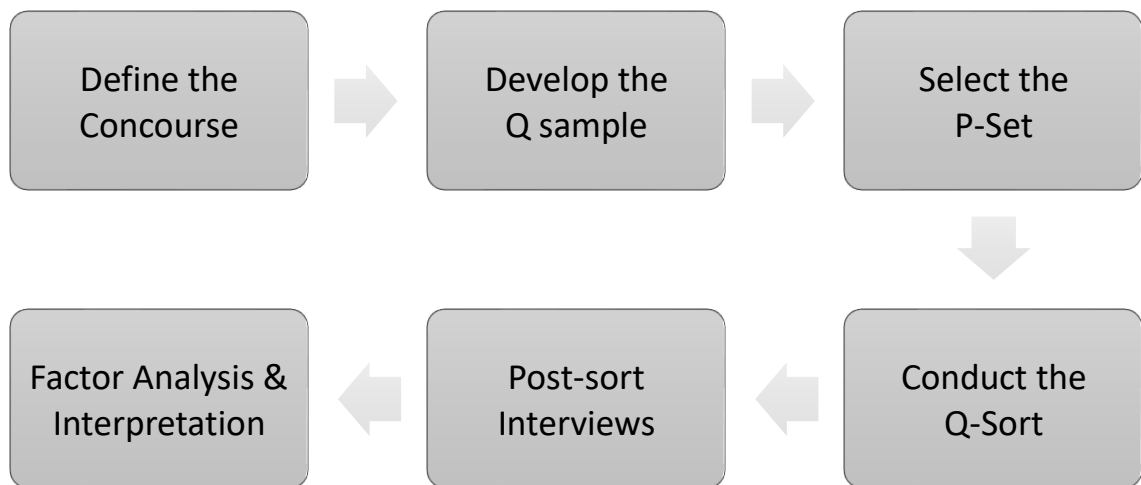
Source: Illustrated for this research

Although the number and the name of the steps for a Q study may be presented in a variety of ways, they all follow a general path. A complete path for this method can be plotted as follows:

Figure 5-3 Practical steps for a Q study

RAW DATA: m Q-SORTS OF n STATEMENTS

FACTOR OR PRINCIPAL COMPONENTS ANALYSIS

ADDITIONAL Q ANALYSIS

FINAL f FACTORS

A
Initial data matrix
Sample, resample, or subsample of the raw data
❶

n statements
m Q-sorts

B
Correlation matrix
Method for extraction of factors: PCA or centroid
❷

m
m

C
Unrotated factors
Number of factors selected
❸
Factor rotation method
❹

unrotated factors
U1 U2 U3 U4 U5 U6 U7 U8
m

D
Rotated factor loadings

f factors
m

G
Distinguishing statements

f
n
■ distinct statements

F
z-scores and factor scores

f
n

E
Factor weights

f
m
■ flagged Q-sorts

❺ *Flagging observations: yes or no, and flagging criteria*

A Analytical steps
❶ Research decisions

Source: Adopted from (Zabala & Pascual, 2016)

5.2.4 Concourse

Derived from the Latin word *concursus*, and with a more comprehensive concept than discourse, the concourse is related to anything current around the topic. The prefix *con* is associated with *together*. Concourse in a Q study is comprised of all sorts of data communicated about the research topic (Brown, 2006). According to the founder of Q, Concours is "a random collection of self-referable statements about something" (Stephenson, 1994, p. 5).

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While the word *discourse* implies the concept of *conversation*, and while 'discourse analysis' is more connected with sociolinguistics, the notion of the *concourse* comprises a more extensive concept. In addition to textual data, it can include a photo, music, audio, video, painting, piece of newspaper, or any other type of data related to the topics; not necessarily true facts (Brown, 2006), rather every thoughts expressed by everyone "for whatever meaning and use" (Stephenson, 1994, p. 6). Interviews by people, commentaries from mass media, speeches and lectures, social media, and literature from previous research can also be incorporated in the concourse, regardless of whether they are true or false.

5.2.5 Q-sample

Drawn from the concourse, Q-sample can be a collection of communicable data. Q-sample can be considered as a comprehensive collection of all the concepts presented in the concourse. While concourse comprises raw data, producing Q-sample is a process of summarizing the raw data into a subset which is extensive enough to cover all the issues raised in the concourse, yet, concise enough for participants.

In this sense, Q-samples are usually provided in a set of statements written or printed on card pieces. Statements should represent all the various and even contradictory matters that the study group is thinking or talking about.

The number of statements has no standard rule and will depend on some criteria. In general, the number and content of the Q-sample should carefully be selected in accordance with the context and implementation circumstances. Education, relevant expertise and awareness of the participants, along with available time and place, are among important factors. Usually, 30-50 statements will cover the concourse so that it will be applicable in the process.

5.2.6 P-set (P-Sample)

P-set is a sample of the community to deal with the Q sample. Contrary to what is required in a survey, there is no obligation for sample size and random selection in a Q study. Participants can be any group of people related to the topic, as long as they can provide a variety of perspectives (Brown, 2006).

It should be noted and emphasized that Q is essentially looking for the diversity of viewpoints in a community, not the distribution of such viewpoints. In this sense, a relatively small number of participants will suffice. A large number of participants might only create noise and confuse the situation. On the other hand, since the participants here have the role of variables, their number cannot technically exceed the number of statements.

As stated in its existential philosophy, Q runs for a target pre-selected group of people, or for a small group of people with different opinions (Stephenson, 1952), so that different perspectives are revealed, and/or the similarities between viewpoints are examined. Comparing to quantitative studies and surveys, a Q study inherently involves a very few numbers of participants (Brown, 2006). A sample can include a single person (Good, 2010) which reflects the viewpoint of the same person.

5.2.7 Q-sort

Once Q-sample is precisely defined and P-set is selected, it's time to sort the cards; the stage at which each and every participant plays a serious role. Participants are asked to individually sort the Q-sample according to the instruction they are provided with. Participants rank the statements on a table from the most agreed to the most disagreed (or the least agreed) based their own viewpoints.

Different ways of sorting patterns are applicable; however, it is more popular to sort the statements in the form of a bell curve; In a way that reminds a normal distribution curve. The shape of the distribution is symmetrical; however, neither the range nor the height is not bound to a certain shape (Brown, 2006) and has no effects on factor analysis.

The post-sort interview is also considered as an important task, where possible, to receive more elaboration of participants viewpoint (Brown, 2006)

Figure 5-4 A typical Q-sort table

| Less like how I think | | | | More like how I think | | | | |

-4	-3	-2	-1	0	+1	+2	+3	+4
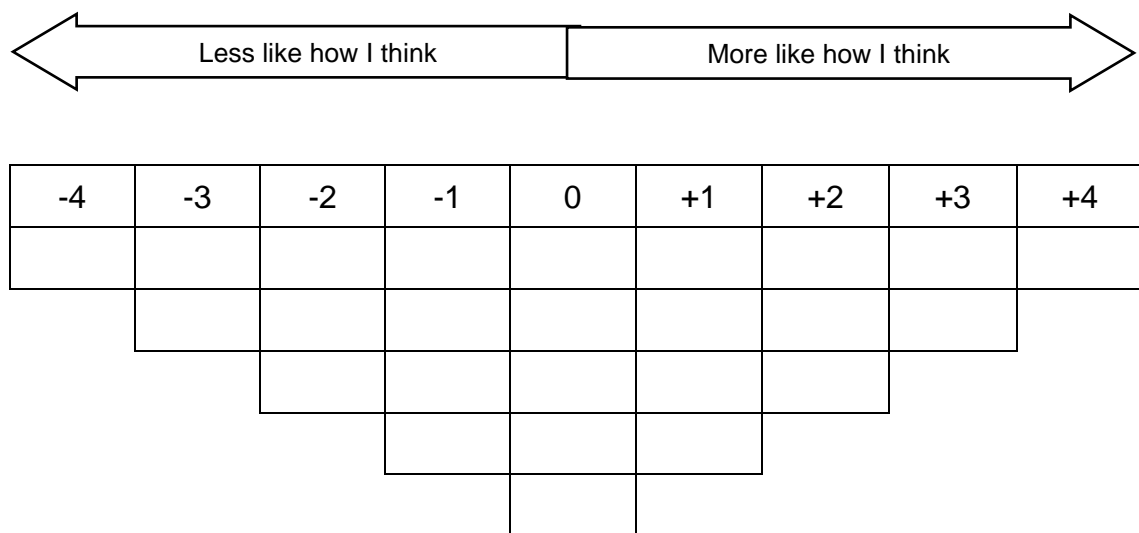
Source: Illustrated for this research

5.2.8 Factor extraction

Factor Analysis is a method for analyzing the variance between several observed variables in order to reach a lower number of unobserved variables (factors). It is used to reduce the dimension of variables to a few meaningful factors.

While in ordinary factor analysis (R methodology), the correlation between traits (variables) are investigated, Q methodology benefits from this technique to reduce the number of participants to a few numbers of factors (*i.e.* viewpoints). Factor analysis is the quantitative stage of a Q study to reveal the factors. The procedure begins by calculating the correlation between individuals, continues by extracting initial unrotated factors, and improves by rotation of remaining factors so that a set of meaningful and significant factors can be extracted.

Correlation between Q-sorts of two given participants is a measure to determine how similar they have been. On the other hand, the amount of correlation would be under-effect of the number of statements (N). A rough estimation of standard error (SE) in this regard, could be calculated as $SE = 1/\sqrt{N}$ (Brown, 2006). The approximate range of 2 to 2.5 times the SE is statistically considered as significant for the correlation (Brown, 2006).

The correlation values between the participants -considering their significance- is the basis for their classification, namely revealing factors. Q-sorts with higher correlations are more likely to belong to the same factors. Consequently, Q-sorters in one factor are more likely to have similar viewpoints on the topic.

Firstly, the correlation between Q sorts are calculated, then the resulting matrix of correlations is used to extract the initial factors. A variety of methods can be used in this regard -namely Centroid Factor Analysis, Principal Component Analysis, or Maximum Likelihood Factor Analysis. The output is a set of unrotated factors.

Then, the *Rotation* technique is applied to transform the unrotated factors into a new set of more understandable factors. Different methods are also applicable to rotate the factors. Particularly in Q methodology, Varimax is considered as the most appropriate -due to its exploratory type of factor analysis.

Another task expected from factor analysis is to determine how many factors would better classify participants' viewpoints. Theoretically, the number of factors may be as many as the number of participants. However, this is not intended due to the nature of the dimension reduction of factor analysis. It is desired to group participants into fewer distinct categories. On the other hand, and practically, there are a limited number of viewpoints for any topic (Brown, 1993).

Statistically, factors with Eigenvalue greater than one are considered as significant. However, other criteria should also be applied. Increasing the number of factors will lead to increasing the total variance explained, as well as increasing the standard errors. This will also result in decreasing reliabilities. So, it would be

a trade-off to choose an appropriate number of factors. One critical issue is that the factors must be meaningful. No matter how great their eigenvalues are; factors must convey a meaningful idea.

Theoretically, each factor represents a certain perspective; However, there is no guarantee that all the perspectives would be revealed, or all the participants necessarily belong to a certain perspective. In fact, each participant might belong to one or more factors (with different extents), or to no factor at all. On the other hand, factors do not necessarily delegate certain participants (Bischof, 2010)

Once the number of factors has been determined, it will also be possible to identify how much each given participant belongs to each factor(s). Factor loadings are the statistic to recognize how correlated is a given participant to each factor.

5.2.9 Interpretation

In ordinary factor analysis, namely in R methodology, factor loadings are the base for factor interpretation. In Q methodology, however, the interpretation should be done by taking into account the statements and their scores in the factors (Brown, 2006). In this sense, each factor will represent a certain type of viewpoint and what it communicates.

Factor scores are the measures to show the relative position of each statement in each factor. Technically, factor scores can be considered as the average viewpoint of all participants constituting the factor. Due to the fact that participants are associated with the factors by different values, the averages are weighted by the factor loadings. In this way, it can be said that the factor represents the common view of a group of individuals and their shared viewpoints.

To be clearer, the statements are then sorted based on these averages but are shown in the same Q-sort format. the factors extracted by this method can be described as a qualitative classification of participants and consequently

be interpreted as different viewpoints. The differentiation of these factors from each other is related to the statements that have a distinctive role in those factors. Distinguishing statements are the ones that have significantly different positions across the factor. On the contrary, consensus statements have a relatively similar position in all factors.

Once the type of factors has been recognized according to the statements with higher ranks, it will also be more distinctive to provide the factors with expositive labels. Labels would particularly be useful, firstly to distinguish the type of factors, and secondly to concisely describe the meaningful insights connected to the factors.

5.2.10 Validity and reliability

Construct validity is considered when a construct is measured: Does it measure what it should measure? Since the Q study is not introduced to measure any construct, this kind of validity does not apply. Content validity is the type of validity that is applicable for Q studies. In this regard, comprehensiveness of the statements would be considered: Are the collected statements so comprehensive that they can represent different opinions? This type of validity can be met, firstly by considering all information sources relevant to the topic, and ultimately by examining the extent to which participants are satisfied with the comprehensiveness of the statements.

The reliability of a Q study is the extent to which each participant sorts the statement in a similar way through the separate practices. One useful and more popular way is to examine the reliability of a Q practice by doing test-retest for a random subset of participants. The reliability of each factor alone is a measure that can be statistically calculated.

5.3 Data gathering

5.3.1 Stage one

Ensuring that a wide range of viewpoints on the issue is addressed, is one of the critical aspects of this methodology. Conducting six semi-structured deep interviews with experts in the dairy industry and market, as well as academic and institutional authorities, the Concours for this study shaped and then enriched through the review in literature and news sources. Using appropriate keywords in the Persian language, the most recent discourses in this field were gathered through the Internet. Aiming to more popular chit-chats, public sources like news websites, blogs, forums, social media, and social networks were considered and scientific publications were consciously ignored.

Since consumer opinions were primarily being intended, scientific facts were not necessarily considered. No matter consumers are right or wrong, they might have a diverse range of attitudes and perspectives. Hence, regardless of being correct or not, the variety of viewpoints was important to be identified as the concourse. The process of data gathering continued to reach a saturation point; where no new data was added to the concourse. Among 112 statements, 30 were extracted as the Q-sample to make sure they are executable and understandable for the public.

In line with 4A's of the marketing mix -previously introduced in other chapters of this thesis, statements were allotted into predefined groups as 'Acceptability', 'Affordability', 'Accessibility', and 'Awareness'. On the other hand, some statements in the Q-sample were not related to any of the above-mentioned groups. They showed a kind of concern and worriedness. By reviewing those statements, two types of concerns were revealed: 'Health Concerns' and 'Environmental Concerns'.

Figure 5-5 Q samples for the study of perspectives on milk and dairy products

Acceptability   Preference (taste, habit, consumption pattern)

- My family and I like milk and take it (or one of its products) in at least one of my daily meals
- I sometimes consume milk or other types of dairy products in addition to daily meals
- By taking milk, I <u>do not</u> face any allergic, digestive, or lactose intolerance problems
- In my family, milk and its products are also used in the recipe for cooking
- In ceremonies, I prefer doogh[14] to coke and yogurt to dessert

Affordability   Economic factors (price and purchasing power)

- Comparing the nutritional value of milk with other foods, the price of milk is expensive
- If my income increases, I will buy more dairy products
- Other living expenses have reduced the purchasing power of the community to buy more dairy products
- Dairy products (yogurt, butter, cheese, doogh, *etc.*) are much more expensive than milk
- The elimination/reduction of subsidies has reduced household milk consumption

Accessibility   Physical access (quality and variety)

- In stores close to me, there is a wide variety of dairy products
- I have access to healthy dairy products
- High-quality dairy products are usually available to me
- My daily schedule does not cause me to miss the time to consume milk. Rarely, I forget to take milk
- It is possible for me to keep milk and dairy products in good condition

---

[14]- A cold savory yogurt-based beverage, popular in Iran

Figure 5-5 Q samples for the study of perspectives on milk and dairy products

Awareness	Consciousness toward the benefits of milk

- Milk has a pro*per* combination of all necessary nutrients and is essential for health

- The consumption of milk is not limited to a particular age (such as infancy and elderly), or for a specific situation (such as sickness, pregnancy, lactation), but is necessary for everyone's daily intake

- Teenagers and athletes need to take more milk

- Milk is the best source of calcium and protein

- Dairy products manufactured in factories are more explicitly under surveillance

Health Concerns

- Milk consumption can cause or exacerbate certain diseases

- I suspect milk and dairy products contain hormone, preservative, or non-dairy fat

- Animal fat/salt/sugar in some dairy products is detrimental to me. I should not take more than the current amount of milk and dairy products

- Governmental organizations are not sufficiently monitoring the production and supply of milk and dairy products

- I suspect that some water and/or milk powder is added to the fresh milk

Environmental Concerns

- Compared with other foods, milk production needs to consume a lot of water and energy

- The production and supply chain of dairy products produce considerable amounts of air polluting gases

- The amount of waste in dairy products is higher than other foods

- The packaging garbage of dairy products is very worrying

- Animal husbandry and production of agricultural products have detrimental effects on the environment

To confirm the comprehensiveness of the statements (in terms of content validation), moreover, to ensure that the practice is well implemented, the process examined by 3 experts in different areas relevant to the dairy market. However - since the consumers' perspectives are more intended- the results from experts were intentionally excluded.

5.3.2 Stage two

After completing the pilot phase -and identifying improvement opportunities- the main practice started with five students in business administration. They volunteered to participate in the process -in the course of a training workshop seminar on Q methodology, held by the author at Bahar Higher Education Institute in Tehran, Iran.

The candidate students were provided with the following Q-sort table (Appendix 2), along with the consent section (Appendix 3) and instruction on how to follow the procedure. Then, through the post-sort interviews (Appendix 4), they were briefly interviewed to get encouraged to provide more explanations and comments on the way they had sorted the statements.

5.3.3 Stage three

The process was then expanded to ordinary people in several situations from diverse social, economic, and demographic classes. A total of 25 participants accomplished a 30-*item* Q-sample. The sorting practices were conducted in the presence of the researcher to ensure that they were correctly implemented, without the researcher having a role or nudge in the choices of the participants. To validate the process, participants were asked to suggest any other statement they believed were missing. However, no new statements were suggested.

5.4 Data analysis and results

5.4.1 Data entry

While SPSS has a possibility to conduct factor analysis, some other features are not specifically provided. Qmethod package (Zabala, 2014), which is specially developed in R programing language to run a full Q methodology analysis (Zabala, 2014) was used in this study.

The package is validated with several datasets, and through extracting a different number of factors (Zabala, 2014). It is also introduced as a reliable application by the International Society for the Scientific Study of Subjectivity (ISSSS) community ("Software – Q Methodology," n.d.). Raw data are shown in Table 5-1.

Table 5-1 Q-sort results for 25 participants sorting 30 statements

S	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25
1	4	2	2	4	0	4	5	1	2	4	2	3	1	1	5	1	4	4	3	1	-5	-5	4	5	2
2	-3	-2	-4	4	5	-5	-5	-3	-2	-1	1	-3	-2	1	-2	-4	-2	-3	-2	-5	-3	5	-1	-2	1
3	3	1	-3	5	4	-1	3	2	1	2	1	1	-1	-1	-1	-1	0	-1	1	2	3	1	-1	-3	-3
4	1	1	4	-2	-4	-1	4	5	3	5	3	1	4	0	1	3	1	3	4	4	-4	-4	-1	1	-2
5	-3	-1	-5	-1	4	-1	-3	-5	0	0	-2	-3	-5	-3	-4	-2	0	1	-5	-1	-1	1	0	-2	-3
6	-2	2	1	-4	1	-2	-1	1	-3	-2	-2	-3	0	-4	-3	3	-5	2	0	-1	3	-4	-3	-4	1
7	0	0	0	1	0	1	2	0	1	-3	1	1	0	2	0	3	3	3	3	3	-4	-3	3	3	-4
8	0	-3	0	3	-2	-3	0	-2	-1	-3	-5	-2	0	2	-1	2	-3	3	0	1	4	4	-2	0	-2
9	-1	-2	3	-2	1	-4	3	1	2	-1	-3	-1	-1	2	3	1	0	-2	-1	4	0	-3	3	-1	-2
10	2	0	5	3	-4	2	2	4	1	1	4	5	5	4	0	4	4	4	4	3	0	-3	-2	0	0
11	3	5	3	-5	1	0	-1	-1	3	3	3	0	1	-3	-5	-3	0	-2	-3	-2	1	1	1	2	3
12	-1	3	-1	0	0	0	-3	-3	-5	0	0	0	-2	-3	-3	-3	-1	-3	0	-2	1	2	-4	3	1
13	1	-1	1	1	-3	0	-1	2	0	-1	2	0	2	1	2	-1	-1	1	-1	0	-3	0	-3	0	-1
14	2	-4	-4	2	2	2	0	-1	-3	2	0	-1	2	1	0	-5	-4	0	-2	2	2	4	2	2	5
15	-2	4	-1	-1	-3	3	1	-2	-4	-4	-2	-4	-4	-4	2	0	3	2	3	0	-2	-2	-3	1	0
16	2	-1	2	1	-3	4	1	3	4	3	2	2	4	3	0	0	-3	-1	-1	0	1	-2	2	0	-1
17	-3	-2	1	-1	0	-4	-1	-1	-3	-2	-1	0	-3	3	-2	-3	-2	-1	-3	-1	-2	3	0	-3	0
18	-4	-3	0	0	-2	-3	-4	-3	1	-5	-3	-4	-1	-5	-1	-1	-2	-3	-4	-4	-3	-2	0	-5	0
19	0	0	-1	2	-2	3	-2	0	-2	-4	0	-1	-3	0	3	1	1	-2	2	-3	-2	1	-1	4	1
20	0	-3	2	-3	2	-2	1	-4	-1	-3	-1	-1	1	0	-2	1	1	0	-2	0	1	-1	4	-1	3
21	4	1	1	1	2	1	3	1	3	2	1	-2	2	-1	2	4	-1	1	1	3	-1	-1	5	4	2
22	-1	1	-2	-2	-5	5	4	3	5	1	4	4	3	5	1	5	3	5	5	5	0	-1	1	-1	-1
23	3	3	3	-3	3	2	-2	-1	-2	1	-1	4	1	0	1	0	5	1	2	-1	5	3	1	-3	4
24	-5	-1	4	-3	3	1	-4	0	0	3	-1	2	-2	-1	-1	-2	2	-4	2	-3	4	3	2	-4	4
25	-1	0	-2	2	-1	3	1	-2	4	4	5	3	-1	-2	4	2	2	2	1	2	-1	-1	-4	-2	-3
26	-2	-4	-2	0	-1	1	0	3	-1	0	0	-5	0	3	3	-4	-4	-5	-1	1	3	0	1	1	3
27	1	2	-3	-4	3	-1	2	2	-4	-1	-3	3	2	4	4	2	2	0	1	1	2	0	-2	-1	-5
28	1	-5	-3	-1	-1	-3	0	4	2	-2	-4	2	-4	-2	1	-1	-1	-1	-4	-2	0	0	3	3	-4
29	5	4	0	3	1	0	-2	-4	-1	1	3	1	2	-1	-4	-2	1	0	-3	-3	2	2	0	2	2
30	-4	3	-1	0	-1	-2	-3	0	0	0	-4	-2	-3	-2	-3	0	-3	-4	0	-4	-1	2	-5	1	-1

5.4.2 Factor analysis and factor extraction

Technically, many factors can be considered as large as the number of participants. However, the research objective is usually to identify fewer distinct factors. Exploratory Factor Analysis (Principal Component Method and then Varimax rotation) was employed to extract distinct and meaningful factors.

Factor Rotation is a technique to transform the unrotated factors into a new set of more understandable factors. This way, factor loadings for each *item* will be stronger on one factor, and much weaker on the others; so that they can be described more easily.

Different numbers of factors can be extracted. Table 5-2 shows that more variance can be explained by increasing the number of factors. Subsequently, the standard errors of factor scores also increase and the reliabilities decreases. Therefore, it would be a trade-off to select the right number of factors to get the appropriate results. One critical criterion in this regard is the extraction of *meaningful* factors.

Table 5-2 Some possible number of factors

No. of Factors	No. of Participants Included	Total variance explained	Reliability	SE of Factor Scores
2	21	41.94%	> 0.97	< 0.16
3	20	50.59%	> 0.92	< 0.28
4	23	58.14%	> 0.94	< 0.24
5	21	64.43%	> 0.92	< 0.24
6	18	70.00%	> 0.80	< 0.45
7	18	75.22%	> 0.80	< 0.45

Four meaningful factors extracted as four distinct viewpoints of participants on milk and dairy products. As seen in Table 5-3, these four factors together can

explain 58.14% of the total variance. They all have 0.94 or greater reliability, and 0.24 or lesser standard errors. 23 participants (out of 25) belong to at least one of these four factors. Eigenvalues for these four factors are all greater than 1. Also, the correlations between factor z-scores are quite weak.

Table 5-3 Characteristics of 4 extracted factors

```
Q-method analysis.


Original data:          30 statements, 25 Q-sorts
Number of factors:      4
Rotation:               varimax
Flagging:               automatic
Correlation coefficient: pearson


General factor characteristics:
   av_rel_coef nload eigenvals expl_var reliability se_fscores
f1         0.8     8      4.84    19.36        0.97       0.17
f2         0.8     7      4.52    18.10        0.97       0.19
f3         0.8     4      3.24    12.95        0.94       0.24
f4         0.8     4      1.93     7.73        0.94       0.24


Total variance explained: 58.14 %


        Correlation between factor z-scores:
            zsc_f1 zsc_f2 zsc_f3 zsc_f4
     zsc_f1   1.00   0.41   0.44   0.08
     zsc_f2   0.41   1.00   0.32   0.12
     zsc_f3   0.44   0.32   1.00   0.04
```

Factor loadings are a measure to show how the participants belong to the factors. Table 5-4 shows how much each participant belongs to each factor.

Table 5-4 Q-sort factor loadings

```
Q-sort factor loadings :
          f1     f2     f3     f4
P01 -0.028  0.636  0.394  0.247
P02  0.106  0.666 -0.542 -0.134
P03  0.174  0.413  0.162 -0.534
P04 -0.039  0.082  0.090  0.754
P05 -0.632 -0.077 -0.034 -0.090
P06  0.245  0.697  0.071  0.205
P07  0.637  0.305  0.545  0.105
P08  0.485  0.116  0.559 -0.100
P09  0.341  0.247  0.446  0.057
P10 -0.119  0.670  0.336  0.002
P11  0.107  0.735  0.174  0.239
P12  0.254  0.626  0.273 -0.155
P13  0.187  0.553  0.549 -0.166
P14  0.217  0.095  0.660  0.017
P15  0.527  0.068  0.361  0.253
P16  0.820  0.219  0.105 -0.208
P17  0.390  0.596 -0.120 -0.066
P18  0.637  0.397  0.103  0.057
P19  0.624  0.522  0.018 -0.084
P20  0.588  0.231  0.571 -0.001
P21 -0.458  0.072  0.166 -0.528
P22 -0.736 -0.139 -0.142  0.056
P23 -0.152  0.070  0.656  0.026
P24  0.094  0.309  0.121  0.623
P25 -0.619  0.358  0.035 -0.139
```

Meanwhile, z-scores (Table 5-5) show how the statements are associated with the factors and eventually, how they can describe the factors.

Table 5-5 Z-scores for the statements

```
Statement z-scores :
   zsc_f1 zsc_f2 zsc_f3 zsc_f4
1   1.280  1.735  1.158  1.914
2  -1.873 -1.090 -0.532  1.361
3  -0.148  0.522 -0.020  0.770
4   1.671  0.885  0.690 -0.341
5  -0.926 -0.776 -1.139  0.091
6   0.554 -1.017 -1.351 -1.881
7   1.275  0.200  0.954  1.038
8   0.267 -1.554 -0.323  0.311
9   0.541 -1.025  1.161 -0.907
10  1.522  1.372  0.930  0.203
11 -1.189  1.136 -0.225 -1.299
12 -1.047  0.103 -2.005  0.412
13  0.107  0.060 -0.099  0.429
14 -1.447 -0.145  0.148  0.948
15  0.726 -0.173 -1.802  0.199
16  0.327  0.804  1.575 -0.064
17 -0.978 -1.088  0.153 -0.549
18 -0.490 -1.853 -1.161 -0.389
19  0.100 -0.058 -0.341  1.313
20 -0.177 -0.750  0.119 -1.140
21  0.735  0.507  1.063  0.780
22  1.847  1.378  1.838 -0.406
23 -0.529  1.151 -0.117 -1.906
24 -1.248  0.049  0.170 -2.045
25  0.918  1.338 -0.953  0.495
26 -0.832 -0.929  0.983  0.042
27  0.666  0.067  0.266 -0.972
28 -0.097 -1.074  0.825  0.476
29 -0.999  1.166 -0.749  0.781
30 -0.558 -0.941 -1.217  0.335
```

Z-scores can also be graphically seen in Figure 5-6.

Figure 5-6 The plot of statement z-scores
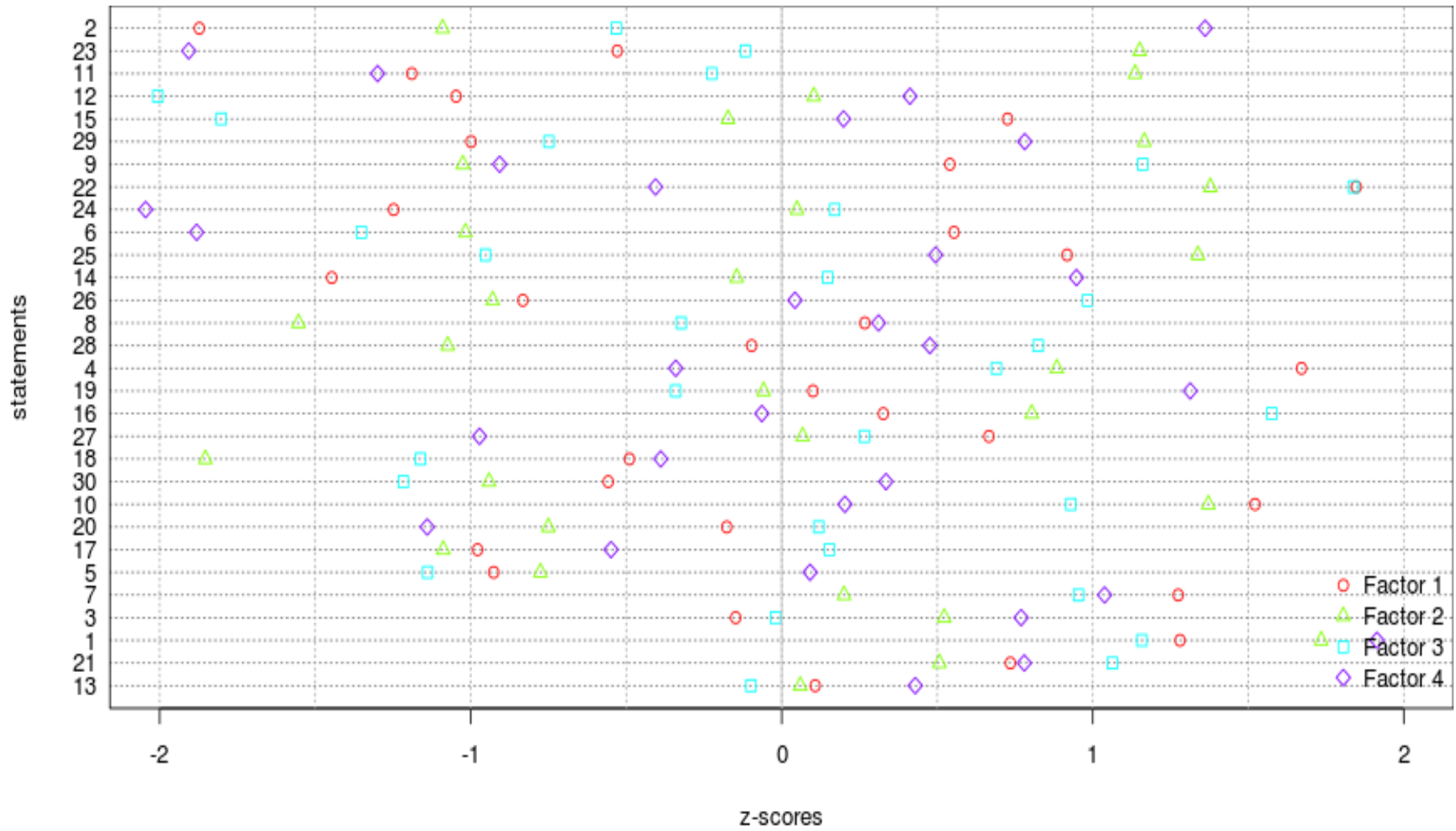
An essential task is to identify distinguishing and consensus statements. The disparity of z-scores could be exceptionally useful in describing the factors. As seen, statements on the top of Figure 5-6 (*e.g.* #2, 23, and 11) clearly distinguish one or more factors from each other. Conversely, statements at the bottom (*e.g.* #13, 21, and 1) cannot significantly distinguish between factors. Such statements are called 'Distinguishing' and 'Consensus' statements, respectively. These types of statements have a fundamental role in the interpretation of factors.

5.5 Interpretation

5.5.1 Labeling factors

Factor Analysis enables Q to distinguish different viewpoints and also to incorporate linked perspectives into meaningful factors (McKeown & Thomas, 2013). Resulted factors can be considered as virtual respondents representing one of the distinct perspectives (Bischof, 2010). Factor arrays (Table 5-6) show the place of each statement in each factor.

'Labeling' is a task in Q methodology, firstly to distinguish the type of factors, and secondly to concisely describe the meaningful insights connected to the factors. Responses and comments gathered in post-sort interviews can be helpful in the interpretation of factors (Brown, 1993), and (McKeown & Thomas, 2013). However, little attention has paid toward post-sort interviews (Gallagher & Porock, 2010). This might be related to the qualitative nature of interviews which seem to be troublesome both for the interviewees to express themselves and also for the researcher to conduct thematic analysis. Compared to the ordinary participants, experts and students showed more cooperation in the post-sort interviews.

Table 5-6 Factor arrays for the four factors

Factor scores

	fsc_f1	fsc_f2	fsc_f3	fsc_f4
1	3	5	3	5
2	-5	-4	-2	4
3	0	1	0	2
4	4	2	1	-1
5	-2	-1	-3	0
6	1	-2	-4	-4
7	3	1	2	3
8	1	-4	-1	0
9	1	-3	4	-2
10	4	4	2	0
11	-3	2	-1	-3
12	-3	1	-5	1
13	0	0	0	1
14	-4	-1	0	3
15	2	-1	-4	0
16	1	2	4	-1
17	-2	-3	1	-2
18	-1	-5	-3	-1
19	0	0	-1	4
20	-1	-1	0	-3
21	2	1	3	2
22	5	4	5	-2
23	-1	3	-1	-4
24	-4	0	1	-5
25	3	3	-2	2
26	-2	-2	3	-1
27	2	0	1	-3
28	0	-3	2	1
29	-3	3	-2	3
30	-1	-2	-3	1

While the scores are important, they cannot necessarily be considered as the only criterion to interpret a factor. Distinguishing and consensus statements would be more helpful in this regard (Table 5-7).

Table 5-7 Distinguishing and consensus statements

	dist.and.cons	f1_f2	sig_f1_f2	f1_f3	sig_f1_f3	f1_f4
1		0.454		0.1225		0.633
2	Distinguishes f1 Distinguishes f4	0.782	**	1.3407	**	3.234
3		0.670	**	0.1278		0.918
4	Distinguishes f1 Distinguishes f4	0.786	**	0.9812	**	2.012
5	Distinguishes f4 only	0.150		0.2125		1.017
6	Distinguishes f1	1.571	**	1.9053	**	2.435
7	Distinguishes f2 only	1.074	**	0.3203		0.237
8	Distinguishes f2	1.821	**	0.5902	*	0.044
9	Distinguishes f1 Distinguishes f3	1.566	**	0.6199	*	1.448
10	Distinguishes f4	0.150		0.5920	*	1.319
11	Distinguishes f2 Distinguishes f3	2.325	**	0.9646	**	0.110
12	Distinguishes f1 Distinguishes f3	1.150	**	0.9584	**	1.459
13	Consensus	0.048		0.2063		0.322
14	Distinguishes f1 Distinguishes f4	1.302	**	1.5946	**	2.394
15	Distinguishes f3	0.899	**	2.5280	**	0.527
16	Distinguishes f3	0.477		1.2489	**	0.390
17	Distinguishes f3 only	0.110		1.1311	**	0.429
18	Distinguishes f2 Distinguishes f3	1.363	**	0.6719	*	0.101
19	Distinguishes f4 only	0.159		0.4412		1.213
20		0.574	*	0.2959		0.963
21	Consensus	0.228		0.3282		0.045
22	Distinguishes f4 only	0.469		0.0092		2.253
23	Distinguishes f2 Distinguishes f4	1.680	**	0.4119		1.378
24	Distinguishes f1 Distinguishes f4	1.297	**	1.4181	**	0.797
25	Distinguishes f3	0.421		1.8702	**	0.423
26	Distinguishes f3 Distinguishes f4	0.097		1.8154	**	0.875
27	Distinguishes f4	0.599	*	0.4005		1.638
28	Distinguishes f2	0.977	**	0.9213	**	0.573
29		2.165	**	0.2500		1.780
30	Distinguishes f4	0.383		0.6587	*	0.893

Table 5-7 Distinguishing and consensus statements (continued)

	sig_f1_f4	f2_f3	sig_f2_f3	f2_f4	sig_f2_f4	f3_f4	sig_f3_f4
1	*	0.58		0.18		0.756	*
2	**	0.56		2.45	**	1.893	**
3	**	0.54		0.25		0.790	*
4	**	0.19		1.23	**	1.031	**
5	**	0.36		0.87	**	1.230	**
6	**	0.33		0.86	**	0.530	
7		0.75	*	0.84	**	0.084	
8		1.23	**	1.87	**	0.635	
9	**	2.19	**	0.12		2.068	**
10	**	0.44		1.17	**	0.727	*
11		1.36	**	2.44	**	1.075	**
12	**	2.11	**	0.31		2.418	**
13		0.16		0.37		0.528	
14	**	0.29		1.09	**	0.800	*
15		1.63	**	0.37		2.001	**
16		0.77	*	0.87	**	1.639	**
17		1.24	**	0.54		0.702	*
18		0.69	*	1.46	**	0.772	*
19	**	0.28		1.37	**	1.654	**
20	**	0.87	**	0.39		1.259	**
21		0.56		0.27		0.284	
22	**	0.46		1.78	**	2.244	**
23	**	1.27	**	3.06	**	1.790	**
24	**	0.12		2.09	**	2.216	**
25		2.29	**	0.84	**	1.447	**
26	**	1.91	**	0.97	**	0.941	**
27	**	0.20		1.04	**	1.238	**
28		1.90	**	1.55	**	0.348	
29	**	1.91	**	0.38		1.530	**
30	**	0.28		1.28	**	1.552	**

It would also be worthy to consider any correlation between factors. As shown in Table 5-8, correlation values between the factors are relatively weak, indicating that the extraction of these factors has led to the identification of distinct perspectives.

Table 5-8 Correlations between the four factors

	f1	f2	f3	f4
f1	1	.435*	.420*	0.025
f2		1	0.285	0.12
f3			1	-0.055
f4				1

* Correlation is significant at the 0.05 level (2-tailed).

By separately sorting z-scores or factor arrays for each factor, and considering distinguishing and consensus statements for each factor, 4 factors were labeled and interpreted as follows:

5.5.2 Factor I: Appreciators

The participants in this group love to consume milk and dairy products in their everyday routines. According to their Q-sorting, they are well aware of the benefits of milk. They have easy access to quality products. They like the products they consume. They don't care about the prices and believe that milk and dairy products are worth the money they pay for. They are less concerned about health issues and the environmental aspects associated with the dairy industry.

Table 5-10 shows the sorting of the statements in descending order of factor arrays for factor I. Distinguishing statements are marked for each factor in the cell corresponding to the statement and the factor. Also, color-coded texts for the statements are as Table 5-9:

Table 5-9 6 The different color codes related to the statements

Code	Description	
Awa	Awareness	
Apt	Acceptability	
Acc	Accessibility	} 4 A's of the marketing mix
Aff	Affordability	
Hlth	Health Concern	
Env	Environmental Concern	

Table 5-10 The sorting of statements for factor I

	#	Statements	f1	f2	f3	f4
Awa	22	Milk is the best source of calcium and protein	5	4	5	-2
Awa	4	Milk has a pro*per* combination of all necessary nutrients and …	4	2	1	-1
Awa	10	The consumption of milk is not limited to a particular age, …	4	4	2	0
Apt	1	My family and I like milk and take it … in one of my daily meals	3	5	3	5
Apt	7	I … consume milk or … dairy products in addition to daily meals	3	1	2	3
Apt	25	In ceremonies, I prefer doogh to coke and yogurt to dessert	3	3	-2	2
Acc	15	My daily schedule does not cause me to miss … milk…	2	-1	-4	0
Acc	21	It is possible for me to keep dairy products in good condition	2	1	3	2
Acc	27	High-quality dairy products are usually available to me	2	0	1	-3
Env	6	…, milk production needs to consume a lot of water and energy	1	-2	-4	-4
Aff	8	If my income increases, I will buy more dairy products	1	-4	-1	0
Acc	9	I have access to Healthy dairy products	1	-3	4	-2
Awa	16	Teenagers and athletes need to take more milk	1	2	4	-1
Acc	3	In stores close to me, there is a wide variety of dairy products	0	1	0	2
Apt	13	I do not face any allergic, digestive, or … problems	0	0	0	1
Apt	19	In my family, milk and its products are also used in the recipe …	0	0	-1	4
Awa	28	Dairy products … in factories are more explicitly under surveillance	0	-3	2	1
Env	18	The amount of waste in dairy products is higher than other foods	-1	-5	-3	-1
Aff	20	Dairy products (…) are much more expensive than milk	-1	-1	0	-3
Hlth	23	Governmental organizations are not sufficiently monitoring …	-1	3	-1	-4
Env	30	Animal and agricultural products have … effects on the environ…	-1	-2	-3	1
Hlth	5	Milk consumption can cause or exacerbate certain diseases	-2	-1	-3	0
Hlth	17	Animal fat/salt/sugar in some dairy products is detrimental to me…	-2	-3	1	-2
Aff	26	The elimination of subsidies reduced household milk consumption	-2	-2	3	-1
Hlth	11	I suspect milk … contain hormone, preservative, or non-dairy fat	-3	2	-1	-3
Env	12	The production … of dairy products produce … air polluting gases	-3	1	-5	1
Hlth	29	I suspect … water and/or milk powder is added to the fresh milk	-3	3	-2	3
Aff	14	Other living expenses have reduced purchasing power …	-4	-1	0	3
Env	24	The packaging garbage of dairy products is very worrying	-4	0	1	-5
Aff	2	Comparing the nutritional value of milk …, milk is expensive	-5	-4	-2	4

5.5.3 Factor II: Mistrustful consumers (Healthily worried)

Factor II has a weak correlation with Factor I (correlation between the two is .435). It seems people in this group have some similarities with participants attributed to factor I. Their Q-sorts indicate that they have a very good Awareness and Acceptability toward milk. However, they are so worried about quality and health issues. They somewhat suspect milk and dairy products might contain hormone, preservative, or non-dairy fat. They have a feeling that some water and/or milk powder is added to the fresh milk. In general, they believe that authorities are not sufficiently monitoring the production and process of milk and dairy products.

5.5.4 Factor III: Indifferent buyers

Comparing to the other three groups, people in this group have the least concern toward the environmental aspect of dairy products. They also care less than average about health issues, as well as Affordability. According to their Q-sorting, and more importantly, considering their post-sort interviews, they buy milk and dairy products according to their habit. They are well aware of the benefits of milk and have also easy access to products; however, they do not like dairy products so much as the other participants. While they are not so worried about health issues or the price of dairy products, it looks like milk and dairy products are not among their top preferences.

5.5.5 Factor IV: Ordinary customers (Economically concerned)

The sorting of statements in this group quite differs from all the other three groups. Participants in this group show the least Awareness and Affordability, in comparison to the other groups. While they do not agree so much on milk benefits, their statements associated with Acceptability have been ranked in higher positions. They have fewer concerns about health or environmental issues. The major concern for this group is economic factors. In their post-sort interviews, they clearly mentioned that in the event of higher incomes or lower prices, they are willing to buy and consume more dairy products. It looks like participants in this group consume dairy products according to their habits. Compared to other groups, people in this group are more sensitive to prices.

Table 5-11 The sorting of statements for factor II

	#	Statements	f1	f2	f3	f4
Apt	1	My family and I like milk and take it ... in one of my daily meals	3	5	3	5
Awa	22	Milk is the best source of calcium and protein	5	4	5	-2
Awa	10	The consumption of milk is not limited to a particular age, ...	4	4	2	0
Apt	25	In ceremonies, I prefer doogh to coke and yogurt to dessert	3	3	-2	2
Hlth	23	Governmental organizations are not sufficiently monitoring ...	-1	3	-1	-4
Hlth	29	I suspect ... water and/or milk powder is added to the fresh milk	-3	3	-2	3
Awa	4	Milk has a pr*oper* combination of all necessary nutrients and ...	4	2	1	-1
Awa	16	Teenagers and athletes need to take more milk	1	2	4	-1
Hlth	11	I suspect milk ... contain hormone, preservative, or non-dairy fat	-3	2	-1	-3
Apt	7	I ... consume milk or ... dairy products in addition to daily meals	3	1	2	3
Acc	21	It is possible for me to keep dairy products in good condition	2	1	3	2
Acc	3	In stores close to me, there is a wide variety of dairy products	0	1	0	2
Env	12	The production ... of dairy products produce ... air polluting gases	-3	1	-5	1
Acc	27	High-quality dairy products are usually available to me	2	0	1	-3
Apt	13	I do not face any allergic, digestive, or ... problems	0	0	0	1
Apt	19	In my family, milk and its products are also used in the recipe ...	0	0	-1	4
Env	24	The packaging garbage of dairy products is very worrying	-4	0	1	-5
Acc	15	My daily schedule does not cause me to miss ... milk...	2	-1	-4	0
Aff	20	Dairy products (...) are much more expensive than milk	-1	-1	0	-3
Hlth	5	Milk consumption can cause or exacerbate certain diseases	-2	-1	-3	0
Aff	14	Other living expenses have reduced purchasing power ...	-4	-1	0	3
Env	6	..., milk production needs to consume a lot of water and energy	1	-2	-4	-4
Env	30	Animal and agricultural products have ... effects on the environ...	-1	-2	-3	1
Aff	26	The elimination of subsidies reduced household milk consumption	-2	-2	3	-1
Acc	9	I have access to Healthy dairy products	1	-3	4	-2
Awa	28	Dairy products ... in factories are more explicitly under surveillance	0	-3	2	1
Hlth	17	Animal fat/salt/sugar in some dairy products is detrimental to me...	-2	-3	1	-2
Aff	8	If my income increases, I will buy more dairy products	1	-4	-1	0
Aff	2	Comparing the nutritional value of milk ..., milk is expensive	-5	-4	-2	4
Env	18	The amount of waste in dairy products is higher than other foods	-1	-5	-3	-1

Table 5-12 The sorting of statements for factor III

	#	Statements	f1	f2	f3	f4
Awa	22	Milk is the best source of calcium and protein	5	4	5	-2
Awa	16	Teenagers and athletes need to take more milk	1	2	4	-1
Acc	9	I have access to Healthy dairy products	1	-3	4	-2
Apt	1	My family and I like milk and take it ... in one of my daily meals	3	5	3	5
Acc	21	It is possible for me to keep dairy products in good condition	2	1	3	2
Aff	26	The elimination of subsidies reduced household milk consumption	-2	-2	3	-1
Awa	10	The consumption of milk is not limited to a particular age, ...	4	4	2	0
Apt	7	I ... consume milk or ... dairy products in addition to daily meals	3	1	2	3
Awa	28	Dairy products ... in factories are more explicitly under surveillance	0	-3	2	1
Awa	4	Milk has a pro*per* combination of all necessary nutrients and ...	4	2	1	-1
Acc	27	High-quality dairy products are usually available to me	2	0	1	-3
Env	24	The packaging garbage of dairy products is very worrying	-4	0	1	-5
Hlth	17	Animal fat/salt/sugar in some dairy products is detrimental to me…	-2	-3	1	-2
Acc	3	In stores close to me, there is a wide variety of dairy products	0	1	0	2
Apt	13	I do not face any allergic, digestive, or ... problems	0	0	0	1
Aff	20	Dairy products (...) are much more expensive than milk	-1	-1	0	-3
Aff	14	Other living expenses have reduced purchasing power ...	-4	-1	0	3
Hlth	23	Governmental organizations are not sufficiently monitoring ...	-1	3	-1	-4
Hlth	11	I suspect milk ... contain hormone, preservative, or non-dairy fat	-3	2	-1	-3
Apt	19	In my family, milk and its products are also used in the recipe ...	0	0	-1	4
Aff	8	If my income increases, I will buy more dairy products	1	-4	-1	0
Apt	25	In ceremonies, I prefer doogh to coke and yogurt to dessert	3	3	-2	2
Hlth	29	I suspect ... water and/or milk powder is added to the fresh milk	-3	3	-2	3
Aff	2	Comparing the nutritional value of milk ..., milk is expensive	-5	-4	-2	4
Hlth	5	Milk consumption can cause or exacerbate certain diseases	-2	-1	-3	0
Env	30	Animal and agricultural products have ... effects on the environ…	-1	-2	-3	1
Env	18	The amount of waste in dairy products is higher than other foods	-1	-5	-3	-1
Acc	15	My daily schedule does not cause me to miss ... milk…	2	-1	-4	0
Env	6	..., milk production needs to consume a lot of water and energy	1	-2	-4	-4
Env	12	The production ... of dairy products produce ... air polluting gases	-3	1	-5	1

Table 5-13 The sorting of statements for factor IV

	#	Statements	f1	f2	f3	f4
Apt	1	My family and I like milk and take it ... in one of my daily meals	3	5	3	5
Apt	19	In my family, milk and its products are also used in the recipe ...	0	0	-1	4
Aff	2	Comparing the nutritional value of milk ..., milk is expensive	-5	-4	-2	4
Apt	7	I ... consume milk or ... dairy products in addition to daily meals	3	1	2	3
Aff	14	Other living expenses have reduced purchasing power ...	-4	-1	0	3
Hlth	29	I suspect ... water and/or milk powder is added to the fresh milk	-3	3	-2	3
Acc	21	It is possible for me to keep dairy products in good condition	2	1	3	2
Acc	3	In stores close to me, there is a wide variety of dairy products	0	1	0	2
Apt	25	In ceremonies, I prefer doogh to coke and yogurt to dessert	3	3	-2	2
Awa	28	Dairy products ... in factories are more explicitly under surveillance	0	-3	2	1
Apt	13	I do not face any allergic, digestive, or ... problems	0	0	0	1
Env	30	Animal and agricultural products have ... effects on the environ...	-1	-2	-3	1
Env	12	The production ... of dairy products produce ... air polluting gases	-3	1	-5	1
Awa	10	The consumption of milk is not limited to a particular age, ...	4	4	2	0
Aff	8	If my income increases, I will buy more dairy products	1	-4	-1	0
Hlth	5	Milk consumption can cause or exacerbate certain diseases	-2	-1	-3	0
Acc	15	My daily schedule does not cause me to miss ... milk...	2	-1	-4	0
Awa	16	Teenagers and athletes need to take more milk	1	2	4	-1
Aff	26	The elimination of subsidies reduced household milk consumption	-2	-2	3	-1
Awa	4	Milk has a pro*per* combination of all necessary nutrients and ...	4	2	1	-1
Env	18	The amount of waste in dairy products is higher than other foods	-1	-5	-3	-1
Awa	22	Milk is the best source of calcium and protein	5	4	5	-2
Acc	9	I have access to Healthy dairy products	1	-3	4	-2
Hlth	17	Animal fat/salt/sugar in some dairy products is detrimental to me...	-2	-3	1	-2
Acc	27	High-quality dairy products are usually available to me	2	0	1	-3
Aff	20	Dairy products (...) are much more expensive than milk	-1	-1	0	-3
Hlth	11	I suspect milk ... contain hormone, preservative, or non-dairy fat	-3	2	-1	-3
Hlth	23	Governmental organizations are not sufficiently monitoring ...	-1	3	-1	-4
Env	6	..., milk production needs to consume a lot of water and energy	1	-2	-4	-4
Env	24	The packaging garbage of dairy products is very worrying	-4	0	1	-5

5.6 Flagging the participants

Identifying the diversity of viewpoints has been more intended in this study. However, as a practice of Q-methodology, it is useful as well to identify which participant is more connected to which factor (*i.e.* to which viewpoint). Principally, each participant could belong to all the factors to a different extent. However, the greater the factor loadings, the more belonging. In this regard, participants are associated with the factors to which they have significantly greater factor loadings.

Flagging the participants attributed to a certain factor could be done through two strategies. 'Automatic' flagging can be applied according to each participant's relatively higher value among factor scores. On the other hand, 'Manual' flagging can also be considered according to some previously known reasons (*e.g.* due to the political orientations, the presence of certain influential people and celebrities, …).

As a result, we can find out which participant belongs more to which factor. Such findings are not absolute and unchangeable. In fact, the classification of participants is related to some criteria. The number of factors has the main role in this regard. By increasing the number of factors, members of a certain factor may move to different factors, regarding their factor loadings in the new set of factors.

Also, each participant may relatively belong to more than one factor, or to no factor at all. It is the aim of the research and proficiency of the researcher to choose the appropriate number of factors so that as many participants as possible would be attributed to a unique factor. As seen, participants 13 and 20 cannot be merely attributed to a certain factor. All the other participants are uniquely connected to just one factor and no more (*i.e.* eight, seven, four, and four people are respectively attributed to factor f1, f2, f3, and f4).

Table 5-14 Attribution of participants to the factors

```
Q-method analysis.
Original data:          30 statements, 25 Q-sorts
Number of factors:      4
Rotation:               varimax
Flagging:               automatic
Correlation coefficient: pearson


Number of Q-sorts flagged for each factor:
   nload
f1     8
f2     7
f3     4
f4     4
```

	flag_f1	f1	flag_f2	f2	flag_f3	f3	flag_f4	f4
P01		-0.03	*	0.64		0.39		0.25
P02		0.11	*	0.67		-0.54		-0.13
P03		0.17		0.41		0.16	*	-0.53
P04		-0.04		0.08		0.09	*	0.75
P05	*	-0.63		-0.08		-0.03		-0.09
P06		0.24	*	0.70		0.07		0.20
P07	*	0.64		0.31		0.55		0.11
P08		0.48		0.12	*	0.56		-0.10
P09		0.34		0.25	*	0.45		0.06
P10		-0.12	*	0.67		0.34		0.00
P11		0.11	*	0.73		0.17		0.24
P12		0.25	*	0.63		0.27		-0.16
P13		0.19		0.55		0.55		-0.17
P14		0.22		0.09	*	0.66		0.02
P15	*	0.53		0.07		0.36		0.25
P16	*	0.82		0.22		0.10		-0.21
P17		0.39	*	0.60		-0.12		-0.07
P18	*	0.64		0.40		0.10		0.06
P19	*	0.62		0.52		0.02		-0.08
P20		0.59		0.23		0.57		0.00
P21		-0.46		0.07		0.17	*	-0.53
P22	*	-0.74		-0.14		-0.14		0.06
P23		-0.15		0.07	*	0.66		0.03
P24		0.09		0.31		0.12	*	0.62
P25	*	-0.62		0.36		0.04		-0.14

5.7 Clustering the participants

In addition to flagging - which is a specific part of Q methodology - clustering is a well-known and widely used technique for assigning members of a larger set to some more homogeneous subsets. More specifically, clustering is:

> "The problem of grouping a data set into several groups such
> that, under some definition of similarity, similar items are in
> the same group and dissimilar items are in different groups".

(Guha & Mishra, 2016, p. 169)

Using SPSS, flagged participants could be grouped into distinct clusters. This practice would be more admirable for marketers and policymakers to take the right action/decision engaging with distinct clusters, namely diverse consumer groups. While clustering seems more applicable for larger datasets, 25 participants in this study were identified as three distinct clusters.

Figure 5-7 Dendrogram for clustering 25 participants in this study
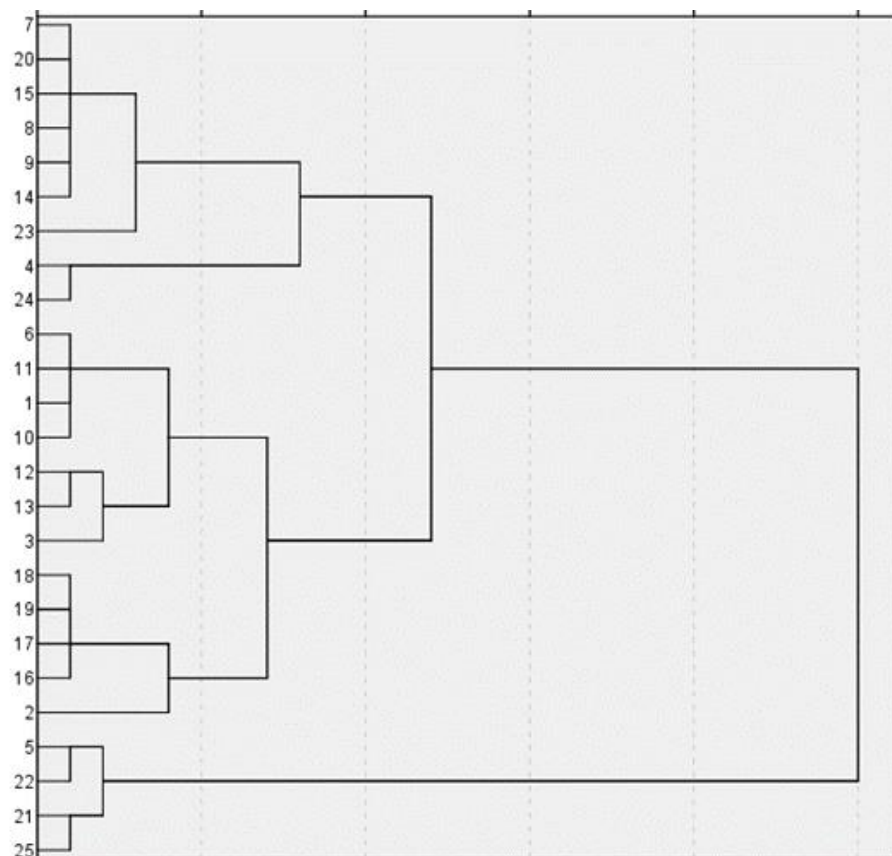
For example, based on the attribution of the participants in the first cluster to each of the four factors (Table 5-15) which are also shown in Figure 5-8, It can be concluded that this cluster of participants was more similar to factor three.

Table 5-15 Attribution of participants in the 1st cluster to the four factors

Participant #	f1	f2	f3	f4
4	-0.04	0.08	0.09	0.75
7	0.64	0.31	0.55	0.11
8	0.48	0.12	0.56	-0.10
9	0.34	0.25	0.45	0.06
14	0.22	0.09	0.66	0.02
15	0.53	0.07	0.36	0.25
20	0.59	0.23	0.57	0.00
23	-0.15	0.07	0.66	0.03
24	0.09	0.31	0.12	0.62

Figure 5-8 Attribution of participants in the 1st cluster to the four factors
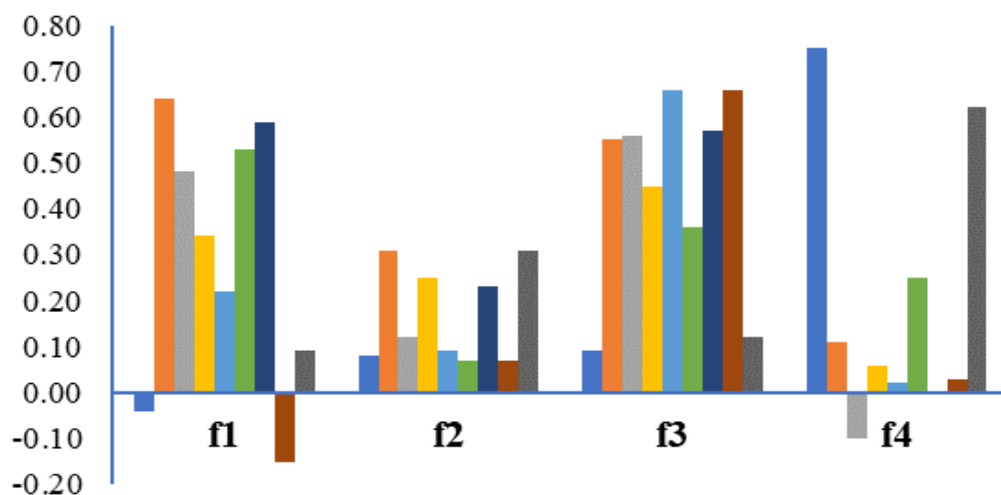
Likewise, it can be concluded that participants in the second cluster were more similar to the second factor. Participants in the third cluster were more similar to the first factor, on the negative side, indeed. Whereas, the first factor (the first

viewpoint) belongs to the Appreciators, the third cluster includes those who dislike dairy products (due to their negative flagging scores).

Table 5-16 Attribution of participants in the 2nd cluster to the four factors

Participant #	f1	f2	f3	f4
1	-0.03	0.64	0.39	0.25
2	0.11	0.67	-0.54	-0.13
3	0.17	0.41	0.16	-0.53
6	0.24	0.70	0.07	0.20
10	-0.12	0.67	0.34	0.00
11	0.11	0.73	0.17	0.24
12	0.25	0.63	0.27	-0.16
13	0.19	0.55	0.55	-0.17
16	0.82	0.22	0.1	-0.21
17	0.39	0.60	-0.12	-0.07
18	0.64	0.40	0.1	0.06
19	0.62	0.52	0.02	-0.08

Figure 5-9 Attribution of participants in the 2nd cluster to the four factors
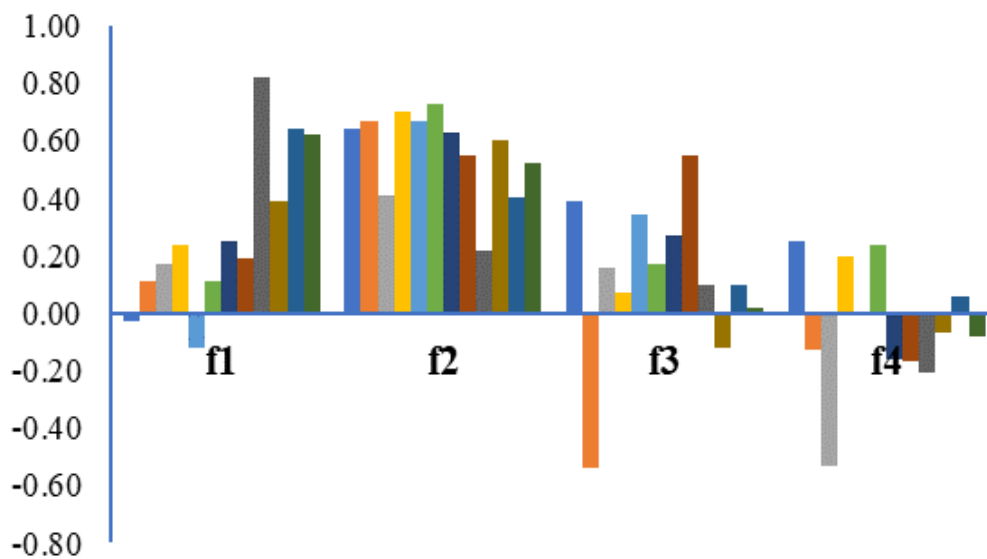
Table 5-17 Attribution of participants in the <u>3rd</u> cluster to the four factors

Participant #	f1	f2	f3	f4
5	-0.63	-0.08	-0.03	-0.09
21	-0.46	0.07	0.17	-0.53
22	-0.74	-0.14	-0.14	0.06
25	-0.62	0.36	0.04	-0.14

Figure 5-10 Attribution of participants in the <u>3rd</u> cluster to the four factors
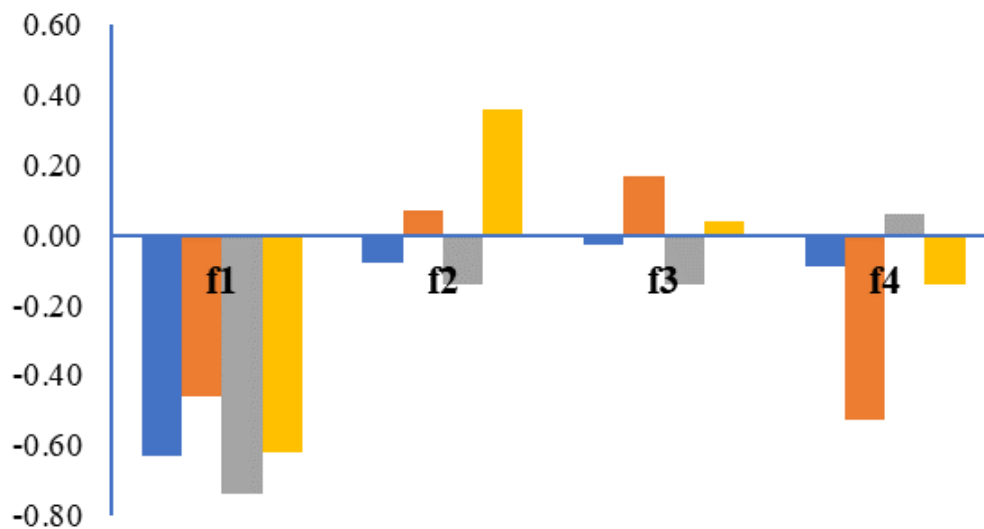
It should also be mentioned and emphasized once again that the frequency of participants in each factor (*i.e.* viewpoints) or in each cluster (*i.e.* segments) is neither intended nor considerable in this study. Technically, Q-methodology is a way of discovering distinct viewpoints, rather than identifying the frequency of each viewpoint in society.

5.8 Discussion and conclusion

Per-capita milk consumption has a great dispersion across countries worldwide. According to FAOSTAT, this amount ranged from less than 4 to more than 400 Kg *per capita per* year in 2013 (FAO, n.d.-b). While the World average *per-capita* milk supply increased from 76.8 kg in 1961 to 112.9 kg in 2013, Iran's *per-capita* milk supply has fluctuated in the range of 46.69 to 78.68 kilograms *per* year (FAO, n.d.-b).

Among many other determinants, consumers' viewpoints toward milk and dairy products have a major role in this regard. Since overconsumption and underconsumption of dairy products have nutritional, economic and environmental effects, it would be important to understand different consumption patterns and take the necessary actions, including appropriate interventions.

Q methodology is a mix-method technique to identify the variety of viewpoints among a group of people. In this study, the concourse related to milk production and consumption in the Iranian dairy market was investigated through six semi-structured deep interviews with experts in the dairy industry and market, as well as academic and institutional authorities. The Concours was then enriched through the review in literature and news sources.

The Q sort was composed of 30 statements which, according to the participants, covered all the concourse. 25 participants from different social and economic classes participated in the sorting. four distinct factors were extracted through exploratory factor analysis. By reviewing factor arrays and Special attention to distinguishing statements, four factors were interpreted as four distinct viewpoints (namely as 'Appreciators', 'Mistrustful Consumers', 'Indifferent Buyers', and 'Ordinary Customers').

It should be suggested that policymakers and marketers will need various measures to deal with different perspectives in Iranian society.

6 FINAL CONCLUSION

Science must be used to improve the life of others.

- Louis Pasteur

6.1 Introduction

Milk and dairy products are among the main components of human food which can be consumed in all three main meals. They can be consumed, directly as part of the meal, or indirectly as an ingredient in other foods. Milk and its various products are also used in other food industries. Overall, milk plays an important role in the nutrition and health of individuals and households. Due to the proper mix of nutrients in milk, nutritionists consider it as an indispensable and irreplaceable commodity in the diet.

On the other hand, from a nationwide perspective, milk plays a decisive role in the food security of the community. The milk industry and the milk market make a significant contribution to the economy of countries as well as to the employment of individuals and households.

However, *per capita* milk consumption in Iran is much lower than in developed countries, significantly below the global average, and far below the amount recommended by nutritionists and authorities. Looking at the trend of milk consumption in the last forty years, it has been observed that in the 1970s, the *per capita* consumption of milk in Iran has been close to the global average and has been increasing. However, this trend has been reversed over the past ten years, and *per capita* milk consumption in Iran has declined.

Considering that there are enough agricultural, livestock and processing capacities in the country and a significant part of these capacities have remained unused, It can be concluded that most of the reasons for the low per capita milk

consumption in Iran should be sought in the demand side (Economic reasons such as consumers' purchasing power and non-economic reasons such as consumers' attitudes).

On the other hand, it can be seen that the increase in milk production has not necessarily led to an increase in consumption. The data show that the export trend of dairy products has always been increasing over the past ten years. However, per capita consumption has steadily been declining.

It can, therefore, be concluded that economic factors, production capacities, or consumption patterns alone cannot be considered as the exclusive determinants of milk consumption; and all of these factors must be considered together. Given the importance of the milk and dairy sector to the health and employment of individuals and society, and also considering many people and sectors involved in the milk value chain, this study aimed to study these factors.

6.2 Review of literature

Milk production and consumption worldwide do not follow the same pattern. Some regions of the World, by their natural and climatic characteristics, produce a greater share of the World's milk. People around the World also have different dietary patterns.

Although the factors affecting the production and consumption of a commodity in general, and milk in particular, are known, the role and quantitative impact of these factors for a particular commodity and within a particular community have been the subject of this study.

Apart from economic factors such as price and purchasing power, consumers' willingness toward food products could be related to a vast variety of other factors (Kearney, 2019), (EUFIC, n.d.-a), (EUFIC, n.d.-b), and (UNEP, 2012). As illustrated by Mozaffarian *et al.* (Figure 2-2), there is a diverse range of factors influencing food choice, which can be studied at the individual, sociocultural, community environment, agricultural, industry, market, governmental, and global level (Mozaffarian et al., 2018).

Based on the European Food Information Council, illustrated in Figure 2-1, major determinants of food choice can be categorized into Biological, Economic, Physical, Social, and Psychological groups (EUFIC, n.d.-b). From another point of view, as presented by Kearney:

> "food consumption is variably affected by a whole range of factors including food availability, food accessibility[15], and food choices, which in turn may be influenced by geography, demography, disposable income, socio-economic status, urbanization, globalization, religion, culture, marketing, and consumer attitude"
>
> (Kearney, 2010, p. 2802).

Finally, several models for the marketing mix were introduced and among them, the 4A's framework was found to be more appropriate for this study. These 4A's are Acceptability, Affordability[16], Accessibility, and Awareness.

6.3 Research design

Following the discussions in the literature review, and based on the theoretical framework presented for this research, two studies were designed and conducted as follows:

- Study one (Chapter 4) investigated a set of socio-economic and regional factors to explain and predict milk consumption across the World.
- Study two (Chapter 5) investigated the subjective viewpoints of Iranian consumers on milk and dairy products. This study aimed to deal with the

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[15]- Food availability implies the capacity of a country to provide an appropriate level of food. Food accessibility indicates the physical and economic access of individuals and households to adequate level of foods. Availability and accessibility can be respectively considered as supply and demand sides of food security (FAO, 2008).

[16]- Here in this framework, Affordability and Accessibility should be respectively considered as economic and physical availabilities.

Acceptability of milk and dairy products in the Iranian dairy market and how Iranian households think about milk and dairy products.

6.4 Regional diversities

Econometric modeling showed that, among several factors examined, HDI can better predict the dependent variable (*i.e. per capita* milk consumption) across the World.

On the other hand, among 19 dummy variables considered for 20 different regions in the World, 10 were significant which means there can be considered 11 different patterns for worldwide milk consumption. As shown in Figure 4-7, milk consumption in these 11 regions of the World exponentially increase based on their HDI scores.

6.5 Consumers' viewpoint

While regional diversities and economic changes play great roles in willingness to buy and purchase milk and dairy products, it is important to understand what and how consumers think about the products.

While economic situations and regional diversities are respectively related to Affordability and Accessibility, consumers' viewpoints are related to their Acceptance which in turn are resulted from their Awareness.

The second study of this research identified four distinguished viewpoints of Iranian consumers on milk and dairy products. It is important to consider the inherent similarities and dissimilarities of these four perspectives and set appropriate measures and action plans to deal with them.

6.6 Overall conclusions

The amount and variety of 'consumption' of a particular commodity in a society corresponds to the 'consumption patterns' of that society, which in turn corresponds to the culture that is subject to constant changes and evolution.

People living in different parts of the World experience diverse cultures affecting their consumption patterns. Even in a particular society, socio-economic diversity can affect customers' purchasing behavior and consumers' food choice.

Food consumption in general and milk consumption in particular, exhibit diverse patterns across the World. Individually, each household and each family member have their own preferences according to their own needs and wants. On the other hand, a community's aggregate food consumption is affected by a range of factors including food availability, food accessibility and food choices (Kearney, 2010). These two viewpoints -helping us to understand consumers' behavior- are interesting for producers and suppliers of food products. The latter might be more related to governments and policymakers to adopt appropriate nutrition and sustainable development decisions toward societies.

As shown in Figure 1-2, there are remarkable differences in average milk consumption between continents. However, averages are not a valid basis for comparison. For instance, the average milk consumption in Europe (200 kg *per capita*) is four times that of Asia (50 kg *per capita*). However, Pakistan in Asia has a per capita consumption of milk similar to Portugal in Europe (185 kg compared to 205 kg). On the other hand, Pakistan's milk consumption *per capita* is more than 8 times that of Bangladesh (22 Kg); Both located in Asia and neighboring India. There are also huge disparities in milk consumptions within other continents.

Purchasing power can be considered as one of the major drivers of consumption. There is a relatively strong correlation between *per capita* milk consumption and *per capita* GDP across countries worldwide. However, there are several contradictory cases: countries with very high incomes and very low milk intake, and *vice versa*. So, other factors such as availability and food choice seem to be more important.

Food consumption patterns (likewise for milk and dairy products) have long been formed and modified as follows:

1. In the course of history and across the World, just as human beings have used the most available, economical and efficient materials to build their

houses, different food consumption patterns have been formed in line with domestically accessible resources. Figure 4-7 clearly shows that among 20 regions across the World, five regions have more milk consumption than the other countries -with the same HDI. The other five regions have milk consumption less than the global pattern.

For example, tropical regions with high ambient temperatures and/or humidity are not so favorable for dairy farming and that is one reason for low milk supply in Africa, East, and Southeast Asia. Milk availability (as well as capabilities for transportation and trade) have had the main role in cooking traditions and practices, describing cultural differences in these areas. This might boost the use of locally produced milk products at first, and motivate the import/export of raw or processed products to meet the requirements, in the next stages.

2. Habits form and change over time, notably in the long run.

"Ninety-nine hundredths or, possibly, nine hundred and ninety-nine thousandths of our activity is purely automatic and habitual, from our rising in the morning to our lying down each night" (James, 1899, p. 57).

On the one hand, any changes in the environment might potentially lead to changes in some habits (Carden & Wood, 2018). Nevertheless, it should also be noted that certain interventions can transform habits (Wood, 2017). So, strongly formed habits might change in the long run, if factors affecting change are consistently present.

On the other hand, while model (4-17 has predicted 99.54 kg of milk consumption for Iran in 2013, the actual amount was 46.7 kg. This remarkable difference indicates that milk consumption in Iran did not follow the regional pattern of similar countries and other factors have also been influencing.

3. The facilitation of communication over time has created food diversification for nations and communities. Urbanization and globalization have been the two major factors in this regard (Kearney, 2010)[17].

   Milk supply trends in the last 50 years, shows that in many East-Asian countries, milk consumption patterns have been rising (FAO, n.d.-b), coordinated with their industrial development as well as their increasing urbanized and globalized culture. Comparing milk supply between South Korea and North Korea in 2013 (29.1 compared to 3.8 Kg/*capita*/year, despite the similar climate and culture) supports this idea. Another example is comparing Hong Kong and China mainland (106 compared to 33 Kg/*capita*/year). In general, trends in milk consumption in China, Japan, and other Far-East Asian countries -with traditionally low milk intake- shows that they have had the greatest growth rate in the last fifty years, along with their economic development.

4. Economic factors could be considered as boosting factors rather than initial triggers. It is quite reasonable that any growth in income could potentially improve a healthier diet. However, according to the FAO (FAO, n.d.-e), this depends on the consumer's awareness of the need for good nutrition; otherwise, additional income may only result in more purchases of similar foods and even less nutritious foods. Following the cultural change, improving economic conditions is an important factor in increasing desirability for milk consumption. This fact is seen in almost all East-Asian countries and most of the South American countries. Some of these countries have a huge impact on the global average of milk consumption because of their large population. In this regard, the most growth is seen in Asia and South America (Figure 1-2 Milk consumption trend across the World for half a century).

5. A growing awareness of nutrition issues gradually affects food consumption patterns toward healthier food choices. On the other hand, habitual behaviors, along with economic barriers, tend to resist such

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[17]- It should be noted here that no official data were found to address globalization or urbanization indices for all the countries studied.

changes. Despite the fact that in recent decades dairy consumption (in particular, drinking milk) has been modestly reduced in developed countries. (Zingone et al., 2017) and (Harwood & Drake, 2018); incremental slopes can be seen in developing countries (FAO, n.d.-b).

6. With increasing globalization, fewer differences and more similarities between nations and communities are expected. This is what really happening, not only toward food choices but also in the case of cultures and languages.

7. Plain milk, as the less complicated and less expensive dairy product, could be consumed to a certain extent in daily food intake. The tendency toward consumption over that amount, along with food safety requirements associated with durability, storage, and transportation, as well as new product development, needs extra and supplementary processes and practices which will lead to increased costs and expenses. One sensible reason for such differences across countries could be tracked in the diversity of products. That is why, in high-income countries, cheese and ice cream consumption is on the rise and liquid-milk consumption is on the decline (Irz & Kuosmanen, 2013).

8. Transition in demographics and lifestyle is another factor affecting the type of desirable dairy products. Despite the increase in milk consumption over the past decades, the relative share of whole milk consumption in dairy products has dropped. The development of new technologies as well as new products has led to an increase in the diversification of dairy products (Barbano, 2017).

9. Human Development Index (HDI) is a three-dimensional composite index of a nation's achievements in the areas of health, education, and income. Being correlated to many other factors, HDI as a single factor was quite significant to explain the amount of milk supply across the World. However, each given country had its own growth curve, corresponding to its geographical area. As shown in Figure 4-7, 164 countries across the World can be categorized into 11 distinct groups, when it comes to their milk

consumption. As seen in this figure, they vary both at the starting points (intercepts) and through their exponential growth patterns (slops).

10. Milk-supply growing curves had an exponential nature, implying that even a slight increase in HDI would lead to larger increases in milk consumption. In particular, this reality will be interesting for policymakers.

11. From the model and findings, it could be concluded that the moderator variable -introducing the geographical area- can specify where the differences in milk consumption occur. On the other hand, the mediator variable (HDI) specifies how such differences take place.

12. In addition to the results generally and universally achieved in the first study, changes in milk consumption in a particular country can be investigated separately for each country.

13. Using a Q method and exploratory factor analysis, the second study revealed four distinct views of Iranians on milk and dairy products. Interpreting the statements used in this study, these four perspectives (*i.e.* four factors) were named as follows:

    a. Appreciators,

    b. Mistrustful consumers (Healthily worried),

    c. Indifferent buyers, and

    d. Ordinary customers (Economically concerned).

14. The data also showed that the participants could be clustered into three different groups so that to determine participants in which cluster are more similar to which factor. This can be of particular interest to policymakers and marketers to make proper decisions and to take relevant actions.

It is worth noting and emphasizing that diverse groups of consumers have various nutritional needs at different stages of their lives. In this sense, *per capita* milk consumption as an average for nations, should not be considered as a uniformly advised amount for individuals. However, a comparison of average milk supply

by countries, as well as observing milk consumption trends in a given country can indicate the economic development of countries. [On the other hand] "milk industry is one of the driving forces and opportunities for the economic development of a given country, especially in terms of increasing employment and entrepreneurship opportunities, increasing national production, improving health status of the community, as well as reducing the complications and deficiencies caused by the low consumption of milk and dairy products" (Ajorloo, 2017, p. 9). For all these reasons, the amount of milk supply in a country could be considered as an indication of economic development, social status, health, and well-being states.

6.7 Limitations of the research

The first study of this thesis was based on modeling the relationships between variables. Although theories have been put forward and tested for many economic relationships, each particular case can be formulated based on the available data. It is possible to predict a dependent variable on a combination of different variables with respect to available data. Therefore, the econometric relation obtained should not be regarded as the only possible relation.

On the other hand, a consumption econometric relationship may apply to a particular commodity and/or to a particular community and not necessarily to another commodity in another community.

An important limitation of this study may be considered as the lack of reliable and consistent data. For example, globalization, urbanization, westernization and minimum wage can be considered and tested as predictors of milk consumption. However, there is no official source for publishing such data worldwide. Prices of milk and dairy products can also be considered as other determining factors in their consumption; nevertheless, such data is available in the case of a few countries. Therefore, variables based on unreliable data were intentionally ignored. Fortunately, the predictability of the model was sufficient with the remaining variables.

Events such as the 1979-revolution, Iraq-Iran war, subsidy payments, industrial renewal, subsidy removal, sanctions, inflation, and changes in purchasing power could be studied as effective variables in milk consumption in Iran. In this context, economic trends and time series relevant to milk consumption in Iran were also studied in the course of this research, as another study, which failed to deliver definite results due to the existence of non-stationary data. Any attempt to transform the data led to poor models. Several other variables were excluded due to the existence of very strong collinearity. On the other hand, over a 43-year period, the base year of Iran's economic data has changed several times, undermining the reliability of the data.

In the second study, identifying the views of consumers was considered. While there are a limited number of viewpoints for any topic (Brown, 1993), the variety of participants can lead to a diversity of views. On the other hand, by the nature of Q-studies, the number of participants cannot exceed the number of Q-samples. A commercial study can take on a broader scope of the concourse and possibly extract more diverse perspectives, or the same perspectives may be interpreted differently depending on the variety of participants.

6.8 Policy recommendation

- The dairy value chain covers a wide range of economic sectors (from agriculture and animal husbandry to industry and trade). This wide range of economic activities deals with a broad extent of laws and regulations. Policies (*e.g.* import and export regulations, subsidies, pricing, *etc.*) have a huge impact on the sector. As a result, the final consumer is very affected by the outputs of this sector. However, there is no centralized organization in Iran (such as a dairy board, as is ordinary in many other countries) that deals with chain-level coordination and policy-making. Institutionalization is a necessity for the sector to strengthen and synchronize the value chain by adopting appropriate and balanced policies.

- In addition to economic outputs, the dairy industry is also concerned with community health, as well as environmental aspects. Raising public awareness can be effective in all of these areas. Businesses pursue

increased awareness through advertising campaigns that are more relevant to their brands and products. Promoting milk consumption patterns and its appropriate culture requires planned interventions by the government, public institutions, and NGOs.

- Animal husbandry and dairy industry, as well as prerequisite sectors in agriculture and livestock inputs, rely on the workforce. In this respect, the dairy industry has great potential for employment and entrepreneurship. By comparing the current intake of milk with the advised amount, the employment capacity in this field can be doubled.

- Publicity and promotion of milk and dairy products are effective only when high quality and diverse products are available to consumers. On the contrary, scandals and rumors have a very destructive and long-lasting negative impact on consumers' perceptions. It is critical that the supervision authorities oversee both the quality standards at the producer level and credible information at the consumer level.

- The efficiency of a value chain is limited to the weakest link in the chain. Due to insufficient institutionalization at the whole level of the dairy value chain, non-constructive competition across suppliers and customers lead to the weakening of the whole chain.

- Policies and regulations can help or hinder the development of any industry. Facilitated regulation and their stability can lead to producer support in long-term planning.

- In addition to quantity and quality, productivity plays an important role in the cost of the product for the consumer. The low productivity in different sectors (from agriculture, production, and processing to supply), imposes higher prices on the consumer and consequently, reduces the incentive to buy.

- Exports are usually supported by governments. It is necessary to pay more attention to the supply of sufficient goods within the country when setting up export and import policies. For example, the very low consumption of

milk and dairy products in Iran necessitates, firstly a review of domestic production support programs, and secondly, a review of import and export policies.

6.9   Directions for future research

According to the literature discussed in Chapter 2, the factors affecting the consumption of a commodity in general, and milk in particular, are numerous and varied. Most studies in this field (especially in Iran) have been related to marketing objectives and have studied a particular product or brand in a specific time and place. At the national level, little research has been done on the milk sector. Such studies are mainly of report type.

This research investigated the regional, economic and subjective factors affecting milk consumption in Iran. These areas were identified as the most important areas in the variability of milk consumption, both between and within communities.

The purpose of this research was to identify the factors themselves and to study the impact of each of them on the dependent variable (in the form of econometric relations). However, the milk value chain is a very large and complex system consisting of a large set of internal and external agents. Studying the behavior of a system (especially its long-term dynamics) requires studying the system as a whole with all the elements and agents that affect it. As for directions for future research, the following studies are suggested:

- The system dynamics study of the dairy value chain in Iran;

- Benchmark studies in different sectors of the value chain, at the domestic level and compared to other countries (*e.g.* through methods such as data envelopment analysis)

- Studies of Total Factor Productivity, and Partial Factor Productivity in different sectors of the value chain;

- Studying the environmental impacts of different parts of the chain and comparing their results with the best practices in the World; in order to focus on competitive advantages;

- Studying Iranian mass media and social media contents about milk;

- Exploring and identifying diverse attitudes toward milk in different regions across the World;

- Also, it will be worthwhile for future studies, to examine the role of awareness against habits.

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Appendix 1 - Data used to investigate regional diversity in milk consumption

Continent	Region	Country	Milk Supply[18]	GDP[19]	HDI[20]	Literacy Rate[21]
1	11	Ethiopia	44.1	1,372	0.396	0.491
1	11	Kenya	94.9	2,777	0.519	0.780
1	11	Madagascar	24.8	1,412	0.483	0.647
1	11	Malawi	8.0	1,099	0.418	0.658
1	11	Mauritius	117.3	18,244	0.737	0.906
1	11	Mozambique	4.8	1,071	0.327	0.588
1	11	Rwanda	7.2	1,607	0.434	0.705
1	11	Tanzania	40.3	2,397	0.476	0.803
1	11	Uganda	37.3	1,667	0.456	0.739
1	11	Zambia	9.7	3,701	0.448	0.634
1	11	Zimbabwe	31.9	1,997	0.397	0.865
1	12	Angola	12.3	6,404	0.508	0.711
1	12	Cameroon	15.3	3,208	0.495	0.750
1	12	Central Africa	13.5	614	0.352	0.368
1	12	Chad	20.6	2,077	0.340	0.402
1	12	Gabon	30.2	17,078	0.683	0.832
1	12	Sao Tome	22.6	2,883	0.525	0.749
1	13	Algeria	141.5	13,716	0.713	0.802
1	13	Egypt	59.5	10,156	0.662	0.752
1	13	Morocco	54.7	7,240	0.591	0.724
1	13	Sudan	141.5	4,323	0.414	0.535
1	13	Tunisia	114.5	10,948	0.712	0.818
1	14	Botswana	117.7	16,111	0.634	0.885
1	14	Lesotho	25.4	2,723	0.461	0.794
1	14	Namibia	73.1	9,578	0.608	0.819
1	14	South Africa	55.8	12,770	0.629	0.943
1	14	Swaziland	56.6	8,140	0.536	0.875
1	15	Benin	8.4	2,002	0.436	0.384
1	15	Burkina Faso	29.8	1,617	0.343	0.360
1	15	Cabo Verde	115.6	6,172	0.586	0.876
1	15	Cote d'Ivoire	6.4	2,980	0.432	0.431
1	15	Gambia	45.7	1,640	0.439	0.555
1	15	Ghana	9.1	3,940	0.558	0.766
1	15	Guinea	20.6	1,771	0.355	0.304
1	15	Guinea-Bissau	19.9	1,471	0.364	0.599

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[18] Kilogram *per capita per* year in 2013 (FAO, n.d.-b)

[19] GDP *per capita*, PPP (Current international $) in 2013 (The World Bank, 2017)

[20] Human Development index in 2013 (UNDP, n.d.-a)

[21] The adult literacy rate among people aged 15 or over in 2013 (UNESCO, n.d.-a)

Continent	Region	Country	Milk Supply[18]	GDP[19]	HDI[20]	Literacy Rate[21]
1	15	Liberia	3.0	847	0.388	0.476
1	15	Mali	98.7	1,856	0.344	0.387
1	15	Mauritania	115.6	3,690	0.467	0.521
1	15	Niger	58.9	905	0.304	0.191
1	15	Nigeria	7.9	5,670	0.471	0.596
1	15	Senegal	16.9	2,273	0.470	0.557
1	15	Sierra Leone	7.0	1,713	0.359	0.481
1	15	Togo	8.0	1,320	0.459	0.665
2	21	Antigua	123.7	19,480	0.760	0.990
2	21	Bahamas	104.8	29,878	0.794	0.956
2	21	Barbados	110.5	16,982	0.825	0.990
2	21	Dominica	136.9	10,216	0.745	0.918
2	21	Dominican Rep.	73.8	12,322	0.702	0.918
2	21	Grenada	86.9	11,655	0.770	0.978
2	21	Haiti	19.0	1,686	0.456	0.607
2	21	Jamaica	91.1	8,305	0.730	0.887
2	21	St. Kitts	87.4	23,180	0.745	0.980
2	21	St. Lucia	80.7	12,849	0.725	0.901
2	21	St. Vincent	87.6	10,549	0.733	0.960
2	21	Trinidad	103.8	32,500	0.760	0.990
2	22	Belize	80.3	8,130	0.702	0.827
2	22	Costa Rica	183.3	14,525	0.773	0.978
2	22	El Salvador	124.3	7,027	0.680	0.884
2	22	Guatemala	46.6	7,249	0.581	0.793
2	22	Honduras	91.3	4,323	0.632	0.885
2	22	Nicaragua	85.2	4,780	0.599	0.828
2	22	Panama	70.3	20,054	0.780	0.950
2	23	Argentina	195.1	20,161	0.811	0.981
2	23	Bolivia	46.0	6,303	0.675	0.957
2	23	Brazil	149.3	15,971	0.730	0.917
2	23	Chile	116.1	22,579	0.819	0.973
2	23	Colombia	108.5	12,725	0.719	0.947
2	23	Ecuador	139.6	11,037	0.724	0.945
2	23	Guyana	141.7	6,930	0.636	0.885
2	23	Paraguay	75.7	8,514	0.669	0.956
2	23	Peru	62.2	11,829	0.741	0.945
2	23	Suriname	49.0	15,957	0.684	0.956
2	23	Uruguay	210.5	19,943	0.792	0.984
2	23	Venezuela	117.8	18,281	0.748	0.954
2	24	Canada	187.8	44,101	0.911	0.990
2	24	Mexico	111.9	16,848	0.775	0.944
2	24	US	254.7	52,782	0.937	0.990
3	31	Kazakhstan	210.9	23,773	0.754	0.998
3	31	Kyrgyz Rep.	210.9	3,229	0.622	0.995
3	31	Tajikistan	130.8	2,526	0.622	0.998
3	31	Turkmenistan	137.1	13,698	0.698	0.997
3	31	Uzbekistan	130.8	5,244	0.654	0.996

Continent	Region	Country	Milk Supply[18]	GDP[19]	HDI[20]	Literacy Rate[21]
3	32	China	32.7	12,368	0.699	0.964
3	32	Hong Kong	105.9	53,536	0.906	0.956
3	32	Japan	72.1	38,974	0.912	0.990
3	32	Korea, Rep.	72.1	32,616	0.909	0.979
3	32	Mongolia	139.8	11,094	0.675	0.984
3	33	Brunei	70.5	81,827	0.855	0.964
3	33	Cambodia	3.5	3,068	0.543	0.772
3	33	Indonesia	14.8	9,980	0.629	0.939
3	33	Lao PDR	2.9	5,294	0.543	0.799
3	33	Malaysia	25.3	24,034	0.769	0.946
3	33	Myanmar	31.5	4,613	0.498	0.756
3	33	Philippines	15.7	6,527	0.654	0.963
3	33	Thailand	29.4	15,287	0.690	0.967
3	33	Timor-Leste	11.0	8,975	0.576	0.675
3	33	Vietnam	16.4	5,200	0.617	0.945
3	34	Afghanistan	62.2	1,913	0.374	0.382
3	34	Bangladesh	21.9	2,935	0.515	0.728
3	34	India	84.5	5,251	0.554	0.721
3	34	Iran	46.7	16,955	0.742	0.868
3	34	Maldives	111.5	13,607	0.688	0.993
3	34	Nepal	52.1	2,239	0.463	0.647
3	34	Pakistan	111.5	4,620	0.515	0.564
3	34	Sri Lanka	35.0	10,596	0.715	0.926
3	35	Armenia	209.0	7,997	0.729	0.998
3	35	Azerbaijan	152.1	17,172	0.734	0.998
3	35	Cyprus	113.3	30,621	0.848	0.991
3	35	Georgia	149.3	8,542	0.745	0.998
3	35	Iraq	22.2	15,754	0.590	0.437
3	35	Israel	193.6	34,129	0.900	0.978
3	35	Jordan	77.7	9,062	0.700	0.979
3	35	Kuwait	157.7	76,668	0.790	0.962
3	35	Lebanon	114.5	14,903	0.745	0.939
3	35	Oman	152.3	43,387	0.731	0.948
3	35	Saudi Arabia	83.7	51,265	0.782	0.947
3	35	Turkey	193.9	22,311	0.722	0.950
3	35	UAE	132.7	63,839	0.818	0.938
3	35	Yemen	44.0	4,008	0.458	0.701
4	41	Belarus	133.7	18,272	0.793	0.997
4	41	Bulgaria	155.7	16,632	0.782	0.984
4	41	Czech	195.2	30,486	0.873	0.990
4	41	Hungary	159.1	24,463	0.831	0.991
4	41	Moldova	155.2	4,700	0.660	0.994
4	41	Poland	205.4	24,719	0.821	0.998
4	41	Romania	238.3	19,859	0.786	0.988
4	41	Russia	163.6	26,240	0.788	0.997
4	41	Slovak Rep.	143.1	27,898	0.840	0.996
4	41	Ukraine	145.0	8,630	0.740	0.998

Continent	Region	Country	Milk Supply[18]	GDP[19]	HDI[20]	Literacy Rate[21]
4	42	Denmark	277.3	46,727	0.901	0.990
4	42	Estonia	284.9	27,496	0.846	0.998
4	42	Finland	341.2	41,294	0.892	1.000
4	42	Iceland	225.8	42,821	0.906	0.990
4	42	Ireland	291.9	48,067	0.916	0.990
4	42	Latvia	225.8	22,676	0.814	0.999
4	42	Lithuania	295.5	26,661	0.818	0.998
4	42	Norway	261.3	67,056	0.955	1.000
4	42	Sweden	341.2	45,673	0.916	0.990
4	42	UK	232.2	39,308	0.875	0.990
4	43	Albania	255.3	10,571	0.749	0.976
4	43	Bosnia	174.0	10,826	0.735	0.985
4	43	Croatia	231.0	21,780	0.805	0.993
4	43	Greece	255.3	26,098	0.860	0.977
4	43	Italy	246.9	36,131	0.881	0.992
4	43	Macedonia	157.9	12,656	0.740	0.978
4	43	Malta	190.1	31,064	0.847	0.941
4	43	Montenegro	255.3	14,870	0.791	0.987
4	43	Portugal	205.0	27,900	0.816	0.954
4	43	Serbia	157.9	13,760	0.769	0.981
4	43	Slovenia	235.0	29,797	0.892	0.997
4	43	Spain	246.9	32,604	0.885	0.981
4	44	Austria	258.1	47,922	0.895	0.990
4	44	Belgium	236.2	43,520	0.897	0.990
4	44	France	341.2	39,524	0.893	0.990
4	44	Germany	258.7	45,232	0.920	0.990
4	44	Luxembourg	255.3	95,591	0.875	1.000
4	44	Netherlands	341.5	48,666	0.921	0.990
4	44	Switzerland	318.7	60,109	0.913	0.990
5	51	Fiji	40.2	8,113	0.702	0.937
5	51	Samoa	52.6	5,681	0.702	0.990
5	51	Solomon Islands	11.5	2,212	0.530	0.766
5	51	Vanuatu	25.2	2,991	0.626	0.852
5	52	Australia	234.5	45,794	0.938	0.990
5	52	New Zealand	137.3	36,220	0.919	0.990

Appendix 2 - 30 Statements translated into Persian

شیر دارای ترکیب مناسبی از همه مواد مغذی بوده و برای سلامتی لازم است. **4**	در فروشگاه‌های نزدیک به من، تنوع کافی از محصولات لبنی وجود دارد. **3**	در مقایسه‌ی ارزش غذایی شیر با دیگر غذاها، قیمت شیر گران است. **2**	من و خانواده من، شیر دوست داریم و حداقل در یکی از وعده‌های غذایی ما، شیر یا یکی از محصولات آن دیده می‌شود. **1**
اگر درآمد من افزایش یابد، مقدار بیشتری لبنیات مصرف خواهم کرد. **8**	گاهی شیر یا یکی از محصولات لبنی را خارج از یک وعده غذایی می‌خورم. **7**	در مقایسه با دیگر مواد غذایی، تولید شیر نیازمند مصرف منابع زیادی از آب و انرژی است. **6**	مصرف شیر می‌تواند منجر به بروز یا تشدید برخی بیماری‌ها شود. **5**
چرخه تولید و عرضه محصولات لبنی، گازهای آلاینده زیادی تولید می‌کند. **12**	احتمال می‌دهم شیر و محصولات لبنی دارای هورمون، نگهدارنده یا چربی غیرلبنی باشند. **11**	مصرف شیر، محدود به سن خاصی (مثل نوزادی و سالمندی) یا برای دوران خاصی (مثل بیماری، بارداری، شیردهی) نیست؛ بلکه هر روز و برای همه لازم است. **10**	همیشه به محصولات لبنی سالم و باکیفیت، دسترسی دارم. **9**
نوجوانان و ورزشکاران نیاز بیشتری به شیر دارند. **16**	برنامه روزانه من باعث نمی‌شود که نتوانم زمانی برای خوردن شیر پیدا کنم. به ندرت، فراموش می‌کنم شیر بخورم. **15**	سایر هزینه‌های زندگی، قدرت خرید متوسط جامعه برای خرید لبنیات را کاهش داده است. **14**	با خوردن شیر، مشکلات آلرژیک (حساسیت)، گوارشی (نفخ و دل درد) یا احساس بی‌حالی و کسالت پیدا نمی‌کنم. **13**
دیگر محصولات لبنی (ماست، کره، پنیر، دوغ و ...) خیلی گران‌تر از خود شیر هستند. **20**	در خانواده من، از شیر و محصولات آن در دستور پخت غذاها هم استفاده می‌شود. **19**	اتلاف و دورریز محصولات لبنی، بیشتر از سایر مواد غذایی است. **18**	چربی حیوانی/ نمک/ قند موجود در بعضی محصولات لبنی برای من زیان‌آور هستند. نباید بیشتر از مقدار فعلی، شیر و محصولات لبنی مصرف کنم. **17**
زباله‌های مربوط به بسته‌بندی محصولات لبنی خیلی نگران‌کننده هستند. **24**	ارگان‌های دولتی، به اندازه کافی نظارت بر فرآیندهای تولید و عرضه شیر ندارند. **23**	شیر بهترین منبع تامین کلسیم و پروتئین است. **22**	امکان نگهداری شیر و محصولات لبنی در شرایط مناسب را دارم. **21**
محصولات تولید شده در کارخانه‌ها، دارای نظارت و کنترل‌های بیشتری هستند. **28**	با توجه به تنوع محصولات و برندها، می‌توانم لبنیات با طعم و مزه دلخواهم را پیدا کنم. **27**	حذف/کاهش یارانه‌ها، مصرف شیر خانوارها را کاهش داده است. **26**	در مراسم‌ها، دوغ را به نوشابه، و ماست را به دسر ترجیح می‌دهم. **25**
		دامداری و تولید محصولات کشاورزی و دامی، تأثیر مخربی بر محیط زیست دارند. **30**	فکر می‌کنم به شیر مقداری آب یا شیر خشک هم اضافه می‌شود. **29**

Appendix 3 - Consent text, completion instructions, and Q table for this study

جدول (۱) چیدمان عبارت‌های کیو

دستورالعمل کار	آگاهی و موافقت

دستورالعمل کار

- حتما تجربیات گوناگونی از مصرف شیر و لبنیات با برندهای گوناگون داشته‌اید.
- هدف اصلی این پژوهش، نخست متمرکز بر خود «شیر»، سپس محصولات اولیه آن (مثل پنیر، ماست و دوغ) است. دیگر محصولات لبنی (مثل خامه، کره، کشک، بستنی و ...) کمتر مورد توجه هستند.
- با این حال، لطفا محصولاتی را که بیشتر مصرف می‌کنید در نظر داشته و احساس کلی خودتان را نسبت به آنها در نظر بگیرید.
- در برخی عبارت‌ها بایستی نظر خانواده و اطرافیان را هم در نظر داشته باشید؛ با این حال، دیدگاه خودتان بیشتر اهمیت دارد.
- برای سادگی، نخست کارت‌ها را در سه گروه موافق، خنثی و مخالف دسته‌بندی کرده، سپس آنها را در جدول (۱) چیدمان کنید.
- کارت‌های هر ستون از ارزش یکسانی برخوردار هستند.
- پس از چیدن همه کارت‌ها، لطفا شماره هر عبارت را در جدول کوچکتری که به شما داده شده است و در خانه مشابه آن بنویسید (جدول ۲).
- لطفا پرسش‌نامه زیر جدول ۲ را هم تکمیل فرمایید.

آگاهی و موافقت

با درود و سپاس از همکاری شما

- این فعالیت کاملا آزادانه و آگاهانه بوده و شما در هر لحظه می‌توانید از ادامه آن خودداری کنید؛ بدون اینکه نیاز به ارایه دلیل و توضیحی داشته باشید.
- از نظر پژوهش‌گر، دیدگاه کاملا درست و/یا کاملا نادرست وجود ندارد. دیدگاه شما هر چه که باشد کاملا محترم بوده و کاملا محرمانه خواهد بود.
- نیاز به نوشتن هیچ گونه دیدگاهی نیست، صرفا طبق دستورالعمل مقابل، عبارت‌های مندرج بر روی کارت‌ها را در جدول زیر چیدمان کنید.
- در صورت انتشار نتایج، صرفا تحلیل و نتیجه‌گیری کلی منتشر شده و هیچ گونه اشاره‌ای به هویت و مشخصات فردی نخواهد شد.

کاملا موافق هستم / **کاملا مخالف هستم**

−۵	−۴	−۳	−۲	−۱	۰	+۱	+۲	+۳	+۴	+۵

Appendix 4 - Q-sorting and post-sort interview questionnaire for this study

جدول (۲) چیدمان عبارت‌های کیو

کاملا مخالف هستم   کاملا موافق هستم

-۵	-٤	-۳	-۲	-۱	۰	+۱	+۲	+۳	+٤	+۵

با سپاس از همراهی شما، لطفا پرسشنامه زیر را هم تکمیل فرمایید:

اطلاعات شخصی از شما خواسته نخواهد شد. نظرات شما کاملا محترم بوده و به صورت فردی افشا نخواهند شد

۱- جنسیت: ☐ زن   ☐ مرد

۲- دامنه سنی: ☐ کمتر از ۳۰ سال   ☐ ۳۰ تا ٤۰ سال   ☐ ٤۰ تا ۵۰ سال   ☐ بیش از ۵۰ سال

۳- آیا خرید لبنیات خانواده با شماست؟

☐ گاهگاهی   ☐ بیشتر اوقات   ☐ همیشه

٤- لطفا در مورد عبارتی که با آن کاملا موافق بودید (جایگاه ۵+) توضیح کوتاهی بدهید:

۵- لطفا در مورد عبارتی که با آن کاملا مخالف بودید (جایگاه ۵-) توضیح کوتاهی بدهید:

۶- اگر فکر می‌کنید علاوه بر ۳۰ عبارت مندرج در کارت‌ها، عبارت(های) دیگری هم باید نوشته می‌شدند لطفا بنویسید:

           •

           •

           •

۷- با در نظر گرفتن همه موارد اقتصادی، بهداشتی و ... فکر می‌کنم مصرف شیر و لبنیات جامعه:

☐ خیلی کم   ☐ کم   ☐ به اندازه کافی   ☐ بیش از مقدار توصیه شده است

و باید: ☐ کاهش یابد   ☐ در همین مقدار حفظ شود   ☐ افزایش یابد

برای هماهنگی پرسش‌های احتمالی و/یا ارسال نتایج، لطفا یک آدرس ایمیل هم به صورت خوانا بنویسید:

آدرس ایمیل شما محفوظ بوده و به جز موارد مرتبط با این پژوهش، هیچ گونه مکاتبه‌ای با شما انجام نخواهد شد.