Deanship of Graduate Studies
Al-Quds University

A Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for dairy industries in Palestine

Iman Mousa Khalaf Bajali

MBA Thesis

Jerusalem - Palestine

1444/2022

A Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for dairy industries in Palestine

Prepared by:

Iman Mousa Khalaf Bajali

B.Sc. Electronic Engineering

Al-Quds University, Palestine

Supervisor: Dr. Salwa A. Barghouthi

A thesis submitted in partial fulfillment of requirements for the degree of

Master in Business Administration from the Institute of Business and

Economics – Al-Quds University

1444 Hijri / 2022 C.E

Al-Quds University

Deanship of Graduate Studies

Institute of Business and Economics

Thesis Approval

A Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for dairy industries in Palestine

Prepared by: Iman Mousa Khalaf Bajali

Registration Number: 21910108

Supervisor: Dr. Salwa Barghouthi

Master thesis submitted and accepted, Date: August, 1st, 2022

The names and signatures of examining committee members are as follows:

1. Head of Committee: Dr. Salwa Barghouthi Signature
2. Internal Examiner: Dr. Claude Elama Signature
3. External Examiner: Dr. Raed Iriqat Signature

Jerusalem – Palestine

1444 Hijri / 2022 C.E

Declaration

I certify that this thesis is submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed:

Iman Mousa Khalaf Bajali

Date: 1/8/2022

Dedication

To my father who is always here whenever I need, giving me advices and supporting me.

To my mother I would like to express my gratitude for her words of encouragement and for staying by my side throughout all this experience.

To my sister Samah I thank you wholeheartedly for your wonderful support whilst writing this thesis.

To my sister Nagham I sincerely appreciate you being supportive in the process.

Acknowledgment

First and foremost, I would like to thank Almighty Allah for providing me with the strength, determination, and guidance needed to complete this research.

I would like to express my heartfelt gratitude to my supervisor, Dr. Salwa Barghouthi.

I'd also like to thank members of the committee, Dr. Claude Elama and Dr. Raed Iriqat for enriching this thesis.

I would like to express my gratitude to the dairy factories employees who responded to the questionnaire; without them, this research would not have been completed.

Abstract

This research provides a fuzzy Bayesian network model for successfully managing quality in O2O e-business models in order to determine the best path for dairy products supply chain quality. Such a model is able to effectively reflect the uncertainty inherent in the process, leading to the development of a comprehensive system for selecting and evaluating quality.

The designed questionnaire was used to collect data. The questionnaire consists of different variables including the stages of milk production from the production of milk at the farm to the delivery stage. The questionnaire was distributed in two ways: electronically and manually. We received 31 responses, and each question was evaluated and analyzed using the SPSS software. And a simulation was performed to demonstrate that the suggested methodology (Fuzzy Bayesian Model) is relevant for efficiently controlling quality in O2O e-commerce.

A Fuzzy Bayesian Network Model to study the feasibility of quality management in the dairy industry in Palestine has a high degree of acceptability that's according to the results of the following stages: product preparation (production of milk at farm), production and distribution processing (production stage) , sorting process (controlling process) and delivery links which all had a high degree approval.

In conclusion, this model has the potential to be implemented in Palestine.

Keywords: dairy quality; dairy quality management; O2O model; Fuzzy logic; Bayesian network; Fuzzy Bayesian network.

ضبابية نموذج شبكة بايزي لإدارة الجودة في الأعمال التقليدية - الإلكترونية لصناعات الألبان في فلسطين

إعداد: ايمان موسى خلف بجالي

إشراف: الدكتورة سلوى البرغوثي

ملخص الدراسة

يوفر هذا البحث نموذج (Fuzzy Bayesian Network) وذلك لإدارة الجودة بنجاح في نماذج الأعمال الإلكترونية O2O من أجل تحديد أفضل مسار لجودة سلسلة توريد منتجات الألبان. يعتبر هذا النموذج قادرا على أن يعكس بشكل فعال عدم اليقين المتأصل في هذه العملية، مما يؤدي إلى تطوير نظام شامل لتقييم الجودة.

فحص خبراء الاستبانة المصمم الذي تم استخدامه لجمع البيانات. تهتم الاستبانة بالعديد من المتغيرات تتضمن مراحل انتاج الحليب من المزرعة الى مرحلة التسليم . وقد تم توزيعها بطريقتين: الكترونيا ويدويا. تلقينا 31 من الردود على الاستبانة، ثم تم تقييم كل سؤال وتحليله باستخدام برنامج SPSS . يلي ذلك إجراء محاكاة لإثبات أن المنهجية المقترحة (Fuzzy Bayesian Network) مناسبة للتحكم بكفاءة في الجودة في التجارة الإلكترونية (O2O).

نموذج (Fuzzy Bayesian Network) لدراسة إدارة الجودة في صناعة الألبان في فلسطين لديه درجة عالية من القبول وذلك وفقًا لنتائج المراحل التالية: إعداد المنتج(انتاج الحليب لخام في المزرعة) ، ومعالجة الإنتاج والتوزيع (مرحلة الانتاج)، وعملية الفرز(عملية التحكم) والتسليم التي كان لها جميعًا موافقة بدرجة عالية.

في الختام، هذا النموذج يمكن تطبيقه في فلسطين.

الكلمات الرئيسية: جودة الألبان؛ إدارة جودة الألبان؛ نموذج O2O ؛ المنطق الضبابي؛ شبكة بايزي ؛ شبكة بايزي الضبابية.

Table of Contents

Declaration	I
Dedication	II
Acknowledgement	III
Abstract	IV
ملخص الدراسة	V
Table of Contents	VI
List of Tables	VIII
List of Figures	IX
Chapter I - Background of the Study	1
1.1 Introduction	2
1.2 Problem Statement	3
1.3 Objectives of the Study	3
1.4 Research Questions	4
1.5 Hypothesis	4
1.6 Research significance	5
1.7 Research Model	6
1.8 Scope of the Study	7
Chapter II - Theoretical Framework & Literature Review	8
2.1 Fuzzy	9
2.2 Bayesian network	19
2.3 Fuzzy Bayesian network model	25
2.4 O2O e-business	29
2.5 Quality of food in O2O e-business	36
2.6 Quality Management in the food industry	41

2.7 Literature Review 61

2.8 What distinguishes this study from other studies 64

Chapter III - Methodology 66

3.1 Research Method 67

3.2 Data Sources 67

3.3 Research Population 67

3.4 Research Sample 68

3.5 Variables Description of Research Sample 69

3.6 Primary Research Tool 70

3.7 Test of Validity and Consistency 71

3.8 Research Procedure 72

3.9 Statistical Processing Tool used for Questionnaire Analysis 72

Chapter IV - Data Analysis 73

4.1 General results 74

4.2 Research Questions Results 81

4.3 Discussion 103

Chapter V - Conclusions & Recommendations 107

5.1 Conclusions & Recommendations 108

References 113

Appendices

List of Tables

Number	Name	Page
(1.1)	The variables influencing the quality of dairy products	6
(3.1)	The largest dairy factories in Palestine	67
(3.2)	Sample Distribution Relative to Personal Questions	69
(3.3)	Cronbach Alpha for dimensions and total score	71
(4.1)	Number of dairy cows	74
(4.2)	Statistics for the number of dairy cows	74
(4.3)	Number of times that cows milked daily	75
(4.4)	Statistics for the number of times that the cows milked daily	75
(4.5)	Milk quantity in liters	75
(4.6)	Statistics for Milk quantity in liters	75
(4.7)	Related to the cow farm and safety measures	76
(4.8)	Plans to increase raw milk production	77
(4.9)	Constraints face the dairy farms	78
(4.10)	Tests before and after production	81
(4.11)	Types of Tests	81
(4.12)	The daily rate of milk production in the factory in liters	82
(4.13)	Statistics for the daily rate of milk production in the factory in liters	83
(4.14)	Average time period between milking and the milk entering the manufacturing process	83
(4.15)	Statistics for the average time period between milking and the milk entering the manufacturing process	84
(4.16)	About the effect of the time period between milking and production	84
(4.17)	Statistics for the Factory temperature in C	85
(4.18)	Maintenance frequency	85
(4.19)	Factory quality system	86
(4.20)	The delivery of the factory	86
(4.21)	The stage of preparing the products	88
(4.22)	Production and distribution processing	90
(4.23)	Sorting process	91
(4.24)	Delivery links	91
(4.25)	Recognized Effectiveness of Online Product Reviews	93
(4.26)	The perceived effectiveness of online product descriptions	93
(4.27)	Trust in merchants	94
(4.28)	Purchasing Intent:	95
(4.29)	Arrangement of stages in the Bayesian Network	97
(4.30)	The probability of the event and the equivalent triangular fuzzy number	98
(4.31)	Main stages related to dairy quality management	99
(4.32)	The first stage	99
(4.33)	The second stage	99
(4.34)	The third stage	100
(4.35)	The fourth stage	100
(4.36)	Things to take care of at each stage:	100

List of Figures

Number	Name	Page
(2.1)	Forms of membership functions (a) trapezoidal (b) triangular (c) bell membership function	12
(2.2)	The membership functions for (a) Temperature (b)Humidity	14
(2.3)	The membership function for the whole system	14
(2.4)	The membership functions for (a) Feed (b) Temperature	15
(2.5)	The membership function for the whole system	16
(2.6)	The structure of Fuzzy System	17
(2.7)	Example of Bayesian Network	23
(2.8)	Sales modes (a) Retail mode (b) Dual-channel mode (c) O2O mode	29
(2.9)	Supply process for dairy products in the O2O mode	57
(4.1)	Bayesian network of dairy product quality	95
(4.2)	the probability model	102

Chapter I

Background of the Study

1.1 Introduction

1.2 Problem Statement

1.3 Objectives of the Study

1.4 Research Questions

1.5 Hypothesis

1.6 Research Significance

1.7 Research Model

1.8 Scope of the study

Chapter I

1.1 Introduction:

The internet, mobiles, and social media have had a huge influence on our lives in the few past years. A lot of people use the internet to purchase goods which they want and need either to save time or money. So, seeing this a lot of companies wanted to focus on supplying, marketing, and selling their goods on the internet, this is called e-commerce or e-business.

A new term for e-business showed up recently which is called the Online to Offline (O2O) Business this term of e-business connects the offline and online channels to sell different goods and products.

The benefits of O2O e-business are numerous including transcendence of geographical limitations that shows in the businesses works just offline, customer behavior profiling because it helps in understanding customers' attributes such as customer purchasing power, preferences, and consumption patterns, cost savings related to offline shops by reducing the costs of maintaining and running them, there are a lot of other benefits to having O2O business than just offline business. (Ram & Sun, 2020)

The development of the O2O e-business leads to an increase in its use for food industries especially those that need fresh vegetables, fruits, meat, and seafood and as people go towards a high life quality, taking in consideration that fresh food products have an important place in the food supply. All of this leads that there must be a model to track the quality factors influencing the O2O business in food industries to maintain a high-quality management level.

1.2 Problem Statement

Through reviewing a number of previous studies (Lie et al, 2019; Paiva et al, 2019; Yazdi & Kabir, 2017; Velázquez-Ordoñez, et al, 2019; Zhang et al,2020)

The quality Management -whether applied or not -in Online to Offline (O2O) E-Business for dairy industries in Palestine was not studied before practically thus in this study the purpose is:

"To investigate to what level the quality Management and in O2O E-Business is being applied for dairy industries in Palestine using A Fuzzy Bayesian Network Model".

1.3 Research Objectives:

The main objective of the study is to identify the level at which quality Management is being applied in O2O E-Business for dairy industries in Palestine by studying the factors influencing the quality of dairy in the different stages of the supply chain All of this will be done by using a Fuzzy Bayesian network model. The following sub-objectives will be taken in consideration:

1. Listing the tests that are being performed to the raw milk.
2. Checking the average amount of the produced milk.
3. Monitoring the quality of dairy products across the production chain
4. Checking the main stages of quality management of dairy products
5. Examining the elements that influence the quality of each phase.
6. Double Checking things that should be taken care of in each stage.

The stages of production of dairy products:

1. The preparation for goods stage.

2. The distribution processing stage.
3. The sorting process stage.
4. The delivery links stage.

1.4 Research Questions:

The main question of this research is:

What is the level of quality Management that is applied in O2O E-Business for dairy industry in Palestine? And to arrive at this we should answer the following sub-questions:

1. How many tests are being run on the unpasteurized milk? What are they?
2. How much is the average amount of milk being produced?
3. How are dairy product quality inspections being conducted along the way?
4. What factors have the greatest impact on the level of quality in each phase of production? What should be taken into account while evaluating the quality at each stage?

1.5 Hypothesis:

The following hypothesis should be considered to answer the research questions:

1. All safety and prevention measures would be followed when collecting milk and the farms would strive primarily to confront diseases that affect cows.
2. Daily maintenance and testing of raw milk are done, furthermore at least two tests would be conducted.
3. To achieve the highest quality milk, all practices accessible in farms and facilities should be implemented.

4. Internet and O2O technologies available as of now would be seen in a positive light by the customers for dairy product sales and purchases.
5. The proposed model combination would be approved for the fuzzy Bayesian network.

1.6 Research Significance

According to the statistics of the General Federation of Food Industries, the production capacity of dairy factories ranges from 550-600 tons per day, and basic commodities such as yogurt, labneh, and White Cheese cover about 90% of the Palestinian market, which is the main commodity in the dairy sector.[1]

According to the Investment Promotion and Industrial Estate Agency (PIPA), The most important indications Milk and dairy products industry are: The number of factories is 46, the number of workers is 2324, the investment amount in million dollars is 67 million, the domestic market share ratio is 55% and the export value in millions of dollars is 5 million.[2]

This research is essential to refine the factors influencing dairy quality which is a very important measure for managing and controlling quality and safety to introduce the main points to defend the dairy quality which provides a theoretical basis for solving dairy safety problems.

[1] دنيا الوطن. 2022. الألبان الفلسطينية تستحوذ على الحصة السوقية الأكبر في السوق المحلي. [online] Available at: <https://www.alwatanvoice.com/arabic/news/2018/11/24/1194439.html#:~:text=%D9%88%D8%AA%D8%B5%D8%AF%D8%B1%20%D9%85%D8%B5%D8%A7%D9%86%D8%B9%20%D8%A7%D9%84%D8%A3%D9%84%D8%A8%D8%A7%D9%86%20%D8%A8%D9%85%D8%A7%20%D9%82%D9%8A%D9%85%D8%AA%D9%87,%D9%85%D9%84%D9%8A%D9%88%D9%86%20%D9%84%D8%AA%D8%B1%20%D8%AD%D9%84%D9%8A%D8%A8%20%D8%A8%D9%82%D8%B1%D9%8A%20%D8%B3%D9%86%D9%88%D9%8A%D8%A7%D9%8B.> [Accessed 14 March 2022].

[2] هيئة تشجيع الاستثمار والمدن الصناعية. 2022. PIPA. [online] Available at: <http://www.pipa.ps/ar_page.php?id=1af277y1766007Y1af277> [Accessed 2 July 2022].

1.7 Research Model:

Quality management under O2O E-business:

Table (1.1) The variables influencing the quality of dairy products

Preparation for goods (Production of raw milk at farm)	**Producing and distribution processing (Production stage)**	**Sorting process (Controlling process)**	**Delivery links**
➢ Accept inspection ➢ Barn inspection ➢ Purchase plan ➢ Collecting milk ➢ Unloading ➢ Receiving ➢ Barn's monitoring	➢ Storing raw milk in coolers ➢ Raw milk pasteurization ➢ Cleaning and cooling ➢ Packing (bottle filling) ➢ Refrigeration and transportation	➢ Sorting ➢ Allocation inspection (ensure that each product is in the allotted place) ➢ Final packaging	➢ Delivery plan ➢ Delivery notice ➢ Outgoing quality control ➢ Loading ➢ Transportation and logistics ➢ Temperature control of the whole process ➢ Unloading

1.8 Scope of the Study

The study is limited to employees in dairy factories in Palestine.

The study deals with A Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for dairy industries in Palestine.

The study was done between October, 2021 and June, 2022.

Chapter II

Theoretical Framework and Literature Review

2.1 Fuzzy

2.2 Bayesian network

2.3 Fuzzy Bayesian network model

2.4 O2O e-business

2.5 Quality of dairy in O2O e-business

2.6 Quality Management in the dairy industry

2.7 Littauer Review

2.8 What distinguishes this study from other studies

Chapter II

This chapter clarifies the concepts in the subject of the research starting with the Fuzzy Bayesian network model to the quality management in dairy industry in Palestine, The dairy industry in Palestine is considered one of the largest and most important industries, because the factories depend only on raising cows in farms and from taking raw milk and processing it to obtain dairy products and then selling them to consumers.

2.1 Fuzzy:

A deterministic world would never need fuzziness, but nothing is inevitable, so a world full of complex concepts can be recognized using fuzziness. (Keller et al,2016)
To handle unclear, uncertain, and ambiguous situations which happen in a way like human thinking fuzzy set theory could be used because it consists of many rules which could model ambiguous and unclear items. (Keller et al,2016)

"As far as the laws of mathematics refer to reality, they are not certain. And as far as they are certain, they do not refer to reality."—Albert Einstein[1]

Which may later be interpreted in another way by adding to the laws or completely changing them. With the development of science, new mysterious phenomena will

[1] Albert Einstein said this in a lecture entitled "experience and geometry" in German on 27 January 1921 at the Prussian Academy of Sciences in Berlin.

appear, and science will try to explain them again. Hence the importance of developing the theory of fuzzy logic to study mysterious phenomena.

Fuzzy logic provides a framework in which human thinking and inaccurate data can contribute to risk analysis. In other words, it can be used to assess the risk of insufficient data and incomplete knowledge available, it can help in the organization of these data into clear and concise manner.[1]

The right fuzzy logic system can help to solve the problems of decisions without clear certainties and uncertainties, as evidenced by the growing list of new risks through consistently analyzing these risks. (Shang & Hossen,2013)

The importance of using the Fuzzy logic system:

1. The analysis management and categorization of encountering risks probability. (Burney,2020)
2. Risk assessment. (Shapiro& Koissi,2015)
3. The inference rules of fuzzy logic systems help to identify the cause of a particular risk and also can help to design an efficient and effective minimizing risk strategy. (Shang & Hossen,2013)

[1] Lendave, V., 2022. How can Fuzzy Logic be used for rule-based decision-making?. [online] Analytics India Magazine. Available at: <https://analyticsindiamag.com/how-can-fuzzy-logic-be-used-for-rule-based-decision-making/> [Accessed 1 June 2022].

Fuzzy Logic among other things, is an extension and generalization of binary logic. This allows you to introduce graduality into terms that were previously true or false. (Chevrie & Guely, 1998)

The main characteristics of fuzzy logic:[1],[2]

1. In fuzzy logic, everything has a degree of belonging.
2. Every logical system can be modeled in fuzzy logic.
3. Translate knowledge in fuzzy logic as a set of variables.
4. The conclusion is presented as a logical treatment of an expanded set of flexible conditions.
5. Ease of understanding, flexibility, and tolerance.
6. Modeling of nonlinear systems.
7. Design based on human experience.

Fuzzy sets were designed to formalize soft classification ideas that better match the use of categories in normal language. So, fuzziness is considered just as an implementation of the concept of gradients in all forms of thinking and problem-solving.The contributions of fuzzy sets and fuzzy logic have been found elsewhere in system engineering, data analysis, multifactorial evaluation, uncertainty modeling, operations research and optimization, even mathematics, business and management. (Dubois & Prade, 2016)

[1] Johnson, D., 2022. Fuzzy Logic Tutorial: What is, Architecture, Application, Example. [online] Guru99. Available at: <https://www.guru99.com/what-is-fuzzy-logic.html> [Accessed 1 June 2022].
[2] www.javatpoint.com. 2022. Fuzzy Logic Tutorial - Javatpoint. [online] Available at: <https://www.javatpoint.com/fuzzy-logic> [Accessed 1 June 2022].

For a specified set X, we could define a subset A in different ways. Taking the set X of integer numbers, a subset A is defined either by offering a defining property such as A = {x | x is an odd number between 0 and 10} or listing its elements as A = {1,3,5,7,9}. Another way is defining the subset A by its characteristic function A(x), which is the way to define a fuzzy subset. where $A(x)=\begin{cases}1, x \in A \\ 0, x \notin A\end{cases}$, A: X → [0,1].

The membership function of a fuzzy subset A is a characteristic function from X to [0,1], where A(x) value represents the membership of the point x in the set A or the degree to which x belongs to the set A. for instance taking the set X of natural numbers, a fuzzy subset A could be represented as $A(x)=\begin{cases}\frac{1}{x}, & x>0 \\ 0, & x<0\end{cases}$. The concept of a membership function is the base for All fuzzy set theory. (Keller et al,2016; Zadeh,1965)

A fuzzy set is defined as a set in which each member is represented with a degree of membership, this degree is equivalent to some degree of similarity or compatibility with the concept in which this person is represented by a fuzzy set. Therefore, each member of Fuzzy logic extends this approach by directly modeling language statements, rules, and inference methods with fuzzy sets. (Keller et al,2016)

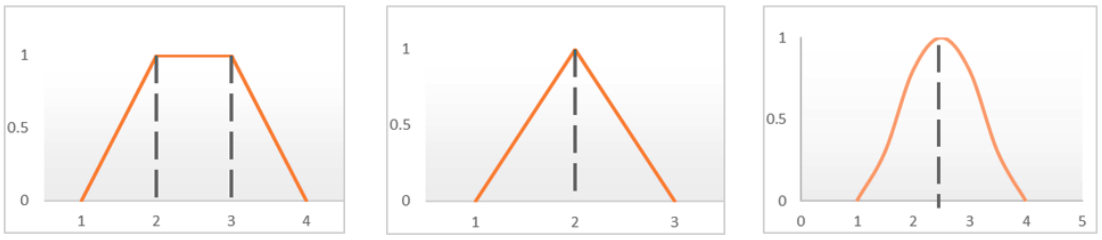
Fuzzy set theory is a great mathematical tool for dealing with the uncertainties caused by uncertainties. Understanding human language and recognizing handwriting is a common cause of blurring.

Fuzzy sets support a flexible sense of membership of elements to set many degrees of membership (between 0 and 1) are allowed.

The value of the membership function does not necessarily have to be a discrete value. Very often it turns out that these are written by continuous functions

Membership functions come in many forms. The shapes could be

triangular, trapezoidal, bell, or other shapes. (Rajasekaran & Vijayalakshmi, 2012)



(a) (b) (c)

Fig. (2.1): Forms of membership functions (a) trapezoidal (b) triangular (c) bell membership function (Siong et al,2011)

There are instances when domain knowledge and, as a result, decision functions regarding a specific topic are best articulated using language norms. For instance, in the case of heart disease risk, we might have regulations like

The overall heart disease risk is low if the external factor risk is fairly low and the health-related risks are fairly low.

To illustrate how fuzzy logic works, here's a simple example. Fuzzy logic makes it possible to express and process relationships in the form of rules. For example, the following rule about the weather. In other words, the weather depends on the temperature and humidity. (Nelles, 2021)

If the temperature is high and humidity is low then the weather is very hot.

Temperature, Humidity, Weather are linguistic variables. The temperature and humidity are inputs whereas weather is output.

All combinations of this fuzzy example:

1. *Temperature* is high **and** *humidity* is high **then** *weather* is medium.
2. *Temperature* is medium **and** *humidity* is high **then** *weather* is cold.
3. *Temperature* is low **and** *humidity* is high **then** *weather* is very cold.
4. Temperature is high **and** humidity is low **then** weather is very hot.
5. *Temperature* is medium **and** *humidity* is low **then** *weather* is hot.
6. *Temperature* is low **and** *humidity* is low **then** *weather* is medium.

(a) (b)

Fig. (2.2): The membership functions for (a) Temperature (b)Humidity (Nelles, 2021)

To do the fuzzy system, divide the input into four subsets (Fig. 3) and associate each subset with a specific weather condition. The following subsets have been individuated. (Sekhari & Savino, 2009)

1. Very cold : when (-1.5 < weather condition < -0.25).
2. Cold : when (-0.75 < weather condition < 0.25).

3. Medium : when (-0.25 < weather condition < 0.75).
4. Hot : when (0.25 < weather condition < 1.5).

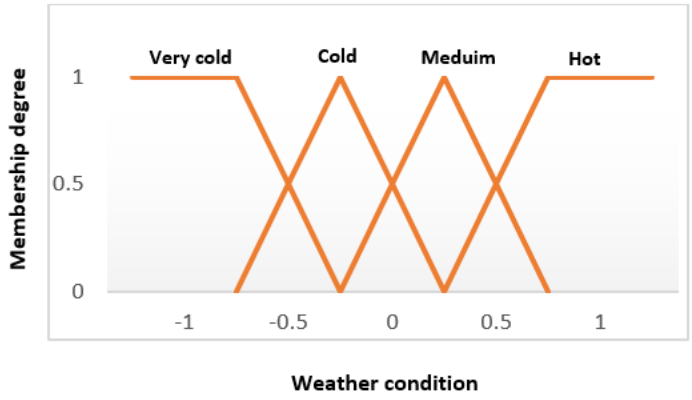


Fig. (2.3): The membership function for the whole system (Nelles, 2021)

It has been shown, that to produce high-quality milk and high-yielding dairy cows eat (50-55) kg of moist feed per day, or (23-25) kg of dry matter (DM) per day.[1] Also, the optimum ambient temperature for dairy cows is between -5 ° C and 18 ° C and if the temperature increases over 20 ° C the cows will suffer from heat stress so it needs additional energy to dissipate heat.[2]

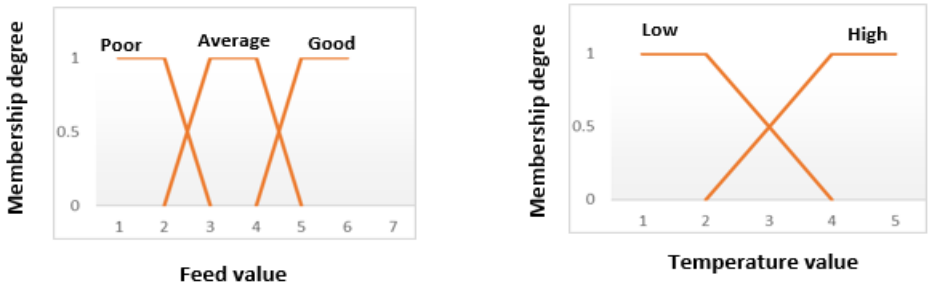
If the feed is high and the temperature is low then the milk quality is very good.

Feed, temperature, milk quality are linguistic variables. The feed and temperature are inputs whereas milk quality is output.

All combinations of this fuzzy example:

[1] DAIRY-CATTLE, 2019. How many pounds of feed does a cow eat in a day? – DAIReXNET. [online] Dairy-cattle.extension.org. Available at: <https://dairy-cattle.extension.org/how-many-pounds-of-feed-does-a-cow-eat-in-a-day/> [Accessed 30 April 2022].
[2] B.V., T., n.d. Lower temperature in cattle stable by 6 to 8 degrees - TS. [online] Tsg-holland.com. Available at: <http://tsg-holland.com/en/about-us/press-release/lower-temperature-in-dairy-cattle-stable/> [Accessed 28 February 2022].

1. *Feed* is good **and** *Temperature* is high **then** *Milk quality* is good.
2. *Feed* is average **and** *Temperature* is high **then** *Milk quality* is medium.
3. *Feed* is poor **and** *Temperature* is high **then** *Milk quality* is very bad.
4. *Feed* is good **and** *Temperature* is low **then** *Milk quality* is very good.
5. *Feed* is average **and** *Temperature* is low **then** *Milk quality* is good.
6. *Feed* is poor **and** *Temperature* is low **then** *Milk quality* is bad.



(a) (b)

Fig. (2.4): The membership functions for (a) Feed (b) Temperature

To do the fuzzy system, divide the input into four subsets (Fig. 2.5) and associate each subset with a specific milk quality. The following subsets have been individuated. (Sekhari & Savino, 2009)

1. Very bad : when (-1.5 < milk quality < -0.25).
2. Bad : when (-0.75 < milk quality < 0.25).
3. Medium : when (-0.25 < milk quality < 0.75).
4. Good : when (0.25 < milk quality < 1.5).

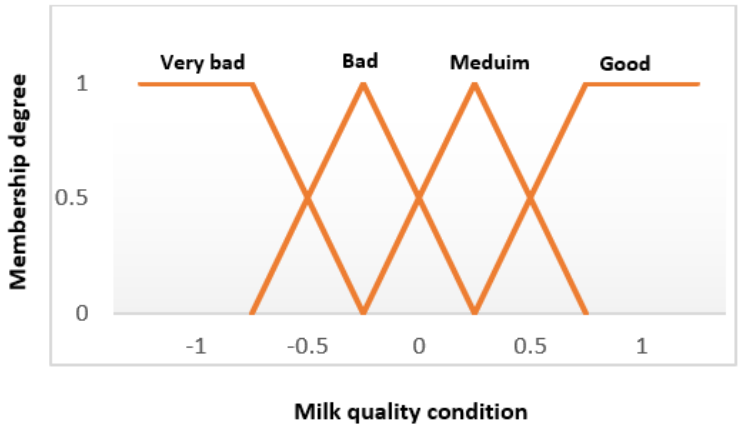


Fig. (2.5): The membership function for the whole system (Nelles, 2021)

For inaccurate data, information and knowledge, we could use fuzzy rules instead of exact rules which will make it more like human thinking, this way of representing data is called a fuzzy system.

Fuzzy systems:" are **rule-based expert systems based on fuzzy rules and fuzzy inference"**. Fuzzy rules represent in a direct method "sensible and logical" knowledge and skills, or knowledge that is internal and subjective, misty, vague, or paradoxical. This knowledge may have come from several and various sources. Sensible and logical knowledge is gained from the long-term experience of people over the years. (Kasabov,1997)

A fuzzy system has three main components to define it:

1. Fuzzy input and output variables.
2. Fuzzy rules.

3. Fuzzy reasoning mechanism.

Fuzzy concepts are generally represented by their membership functions.

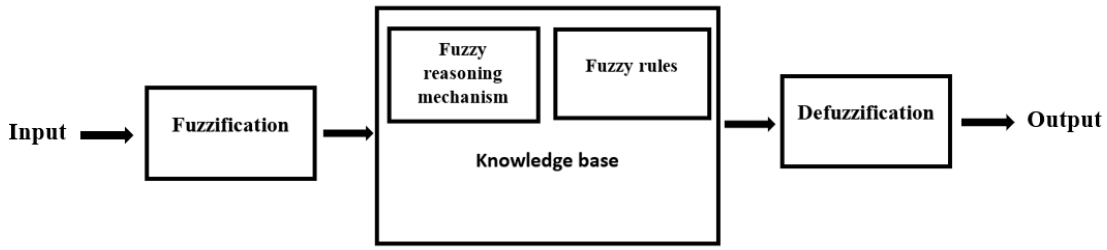


Fig. (2.6): The structure of Fuzzy System

The following are the main algorithmic steps for designing a fuzzy system according to: (Kasabov,1997)

1. Defining the problem then finding the suitable type of fuzzy system for the requirements of this problem.
2. Defining the fuzzy input and output variables, their fuzzy values, and their membership functions.
3. Illustrating the set of guiding fuzzy rules.
4. Selecting the fuzzy inference method, fuzzification, and defuzzification methods if needed.
5. Testing the prototype of the fuzzy system; drawing the purpose function between input and output fuzzy variables; changing membership functions and fuzzy rules if needed; setting the fuzzy system; validation of the results.

The fuzzy rules can be learnt from data that represent a chaotic or a nonchaotic process. And these rules could be used then to model the process and control it. One of the benefits of using fuzzy rules is that they express the process in a linguistic form the which could lead to a better understanding. (Kasabov,1997)

2.2 Bayesian network:

A Bayesian network for probabilistic reasoning was used to index the system's reliability and capture the dependencies between events.
This approach employs expert knowledge and fuzzy set theory to address the uncertainty of the proposed error data in the risk assessment of process industries where events are uncertain and statistically dependent. Bayesian network modeling is used to capture event dependencies and generate a robust probabilistic model. (Yazdi & Kabir, 2017)

Bayesian network is a probabilistic graphical model, used widely in machine learning and data mining because it has a based evidence reasoning which is familiar to human intuition. However, the sophisticated concepts, formulas, and diagrams relating to Bayesian networks may cause some confusion. (Nguyen,2013)

The Bayesian network is a general probabilistic model and not a causal model, it represents the assumption of conditional independence in the model. A related issue is a decision as to whether the two nodes are really independent. In the real world, all nodes

need to be connected. Reasonable assumptions are needed to make it powerful enough for practical use. (Wiegerinck et al, 2011)

A Bayesian network represents a general probability model under a particular variable. In the figure, each variable is represented by a node. Direct dependencies between variables are represented by directed edges between the corresponding nodes, and the conditional probabilities for each variable are stored in the table associated with the dependent node. In Bayes' theorem, these effects can also be identified in the "opposite" direction from the dependent variable to the previous variable. The Bayesian approach to uncertainty provides a way to maintain system-wide consistency and apply models to your data. Graph theory helps explain and use independent structures within a set of interacting variables, facilitating the design of efficient algorithms. (Koski & Noble, 2009)

In Bayesian networks, learning is divided into two categories: structure (related to the graph of conditional relationships) and parameters (related to the strength of conditional relationships). (Lima & Nassar, 2019)

Benefits of using Bayes' theorem it allows to: (Korb &Nicholson, 2011)

1. Update the probabilities of unobserved variables based on some new observations.
2. Automate the process by combining qualitative information about direct dependencies into links and quantitative information about the strength of those dependencies in conditional probability distributions.

To represent and discuss insecure and uncertain domains a graphical structure could be used which is known as the Bayesian network where a set of random variables is represented by nodes, X = X1,X2,…,Xm,Xn,…..from the domain. And a set of controlled links connects pairs of nodes, for example, Xm→ Xn , it represents a direct dependency between variables.

The Bayesian network provides a complete representation of the probability distribution of the entire variable. This means that it can be conditioned by any subset of variables. It supports arbitrary inference lines. (Korb &Nicholson, 2011)

Bayesian networks are part of a class of probabilistic graphical models. These graphical structures are used to represent knowledge about the ambiguous domain. Each node in the graph, in particular, represents a random variable, and the edges between them represent the stochastic dependencies between the corresponding random variables. In Graph, conditional dependencies are frequently calculated using well-known statistical and computational techniques. Therefore, The Bayesian network is derived from graph theory, probability theory, computer science, and statistical principles. (Ruggeri et al, 2007)

Three Phases of Bayesian Network Development:

1. Creating Models through defining random variables, defining structural dependencies between variables, and assigning conditional probabilities to model components.

2. Building an inference engine.
3. Parameter adaptation from data connection using an inference engine for case analysis.

Conditional independence phenomenon is more common and much more acceptable in real-world models.

Case of medical decisions, for instance, are difficult. The difficulty lies in being frequently based on incomplete and uncertain information. Furthermore, the outcome of the decision-making process has far-reaching implications for patients' well-being and even their life.

Human decision-making is far from optimal, according to empirical evidence. Furthermore, its quality deteriorates as the problem's complexity, time constraints, and high stakes increase. As a result, as the number of treatments and drugs available expands, knowledge of human health expands, and diagnostic tests, including genetic testing, become available, healthcare professionals are increasingly called upon to assist in decision making. Simultaneously, rising medical costs and the increased risk of legal action as a result of malpractice are putting pressure on the medical community to operate in a cost-effective and error-free manner. (Onisko, 2008)

To design a Bayesian Network, you need to define at least three things:[1]

[1] Brownlee, J., 2019. A Gentle Introduction to Bayesian Belief Networks. [online] Machine Learning Mastery. Available at: <https://machinelearningmastery.com/introduction-to-bayesian-belief-networks/> [Accessed 24 April 2022].

1. The Random Variables of the problem.
2. The Conditional Relationships between the variables.
3. The Probability Distribution of each variable.

Designing and estimating Bayesian networks have been done by experts in knowledge management and consultancy firms in various industries. Expert confidence in information also influences a priori probabilities. The closest density takes into account belief information to varying degrees, depending on confidence in the belief. (Terán-Bustamante et al, 2021)

Bayesian inference is a type of statistical inference used to update the hypothesis probability which means when there is more evidence or information the belief of the hypothesis becomes higher.[1]

Simple example is presented in (fig 2.7) like if any one got flu, we can do the next network

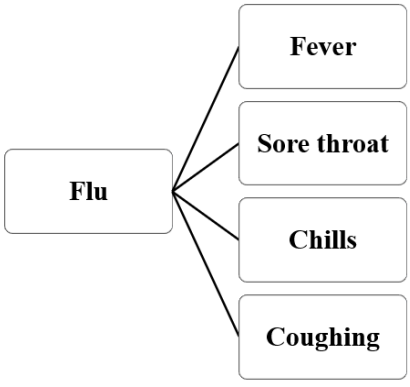


Fig. (2.7): Example of Bayesian Network

[1] En.wikipedia.org. 2022. Bayesian inference - Wikipedia. [online] Available at: <https://en.wikipedia.org/wiki/Bayesian_inference> [Accessed 1 March 2022].

The way of graphing the Bayesian network is called directed acyclic graph (DAG)

This is also referred to as graph topology placement, with each node in a specific order. It is not possible to traverse the graph from one point to the other. Each edge is oriented from the front to the back, so each edge represents a conditional dependency, and each node represents a unique random variable.[1], [2]

This can be presented mathematically like

$$\boldsymbol{P(A|B) = \frac{P(A,B)}{P(B)}}$$

$$\boldsymbol{P(A,B) = \sum_{C} P(A,B,C)}$$

$$\boldsymbol{P(A,B,C) = P(A|A^P).P(B|B^P).P(C|C^P)}$$

P(flu, fever, sore throat, chills, coughing) = P(flu) . P(fever |flu) . P(sore throat |flu) . P(chills |flu) . P(coughing |flu)

2.3 Fuzzy Bayesian network model:

The Simple Fuzzy Neural Network (SFNN) this algorithm: read the data then use the program (function) to classify the data and the result will be as accurate as the given data.

[1] Techopedia.com. n.d. What is a Directed Acyclic Graph (DAG)? - Definition from Techopedia. [online] Available at: <https://www.techopedia.com/definition/5739/directed-acyclic-graph-dag> [Accessed 21 April 2022].

[2] Soni, D., 2018. Introduction to Bayesian Networks. [online] Medium. Available at: <https://towardsdatascience.com/introduction-to-bayesian-networks-81031eeed94e> [Accessed 21 April 2022].

Input features are divided into classes then a maximizer node will find a representative for each class and at the end, there is also an output maximizer that determines the maximum of these fuzzy truths (the maximum of the classes representatives). (Looney & Dascalu, 2007)

Using Bayesian networks for decision-making should be done as follows defining the problem then building the evidence base then simplification of the system finally adaptive learning: which include management, monitoring, and modeling which aims to reduce epistemic uncertainty over time. (Pollino & Henderson, 2010)

Typical safety evaluation techniques must be used in areas where traditional risk assessment techniques are difficult to apply. Inadequate safety data and lack of trust in safety assessments were two major challenges in safety analysis of various engineering activities. The existing algorithm, on the other hand, which can handle fuzzy variables and evaluation variables, is difficult to calculate and takes a long time to estimate the parameters. To address uncertainties such as ambiguity and randomness, a flexible fuzzy Bayesian network approach was used to solve these problems. (Ren et al, 2009)

The fuzzy Bayesian network was obtained by improving the computational process of the Bayesian network. Data can be difficult to obtain and can compensate for the poor Bayesian network performance caused by not considering all influencing factors. (Wang et al, 2014)

Fuzzy Bayesian networks are common, there are many ways to integrate these two tools (Fuzzy and Bayesian models). Many of these techniques differ from each other because they are often used to represent different things. Different techniques used and different notations.

Bayesian networks are a powerful tool that can be applied to a wide range of situations and domains. These are simple and compact methods of representing a general probability distribution. Fuzzy sets can also represent data linguistically, making it easier to understand. The fuzzy membership function also provides a framework for representing membership levels within a set.

The meanings of fuzzy membership values and probabilities are so different that it can be conceptually difficult to combine these two ideas, but they are expressed in the same way (real numbers in the range [0.1]). There are different ways to integrate these two tools, presented by different authors. Because they are frequently used to represent different concepts, many of these techniques differ from one another. Almost all works employ different notations in addition to various techniques. This can make understanding the similarities and differences between various methods difficult. (Ryhajlo et al, 2013)

The equation of Fuzzy Bayesian network are presented here:

Let Y1, Y2, Y3… be a representation of a Bayesian network nodes. **Node** values **are** represented **in lowercase.** For example, the value of Yi is yi. For **an m-node** Bayesian **network,** the joint probability distribution can be shown as below**.**

$$\mathbf{P(Y1, Y2, ..., Ym)} = \prod_{i=1}^{m} \mathbf{P}(\mathbf{Yi} \,|\mathbf{Y1}, \mathbf{Y2}, \ldots, \mathbf{Yi} - \mathbf{1})$$

The probability of node Yi is only dependent on the parent node set of Yi.

$$\mathbf{P(Yi\ |Y1, Y2, ..., Yi{-}1) = P(Yi\ |parent(Yi))}$$

We can simplify this as:

$$\mathbf{P(Y1, Y2, ..., Ym) = \prod_{i=1}^{m} P(Yi\ |parent(Yi))}$$

Let Ω represent the sample space for experiment (K) and consider the mutually incompatible events R1, R2, ..., Rm. R1, R2, ..., Rm form a complete event group which mean they satisfy these conditions:

$\bigcup_{i=1}^{n}$ Ri = Ω, Ri Rj = ∅, P(Ri) > 0, And per the multiplication theorem and conditional probability:

$$\mathbf{P(Ri\ |B) = \frac{P(B|Ri)P(Ri)}{\sum_{i=1}^{m} P(B|Ri)P(Ri)}}$$

The premise and foundation of Bayesian network reasoning is the calculation of conditional probabilities, the set of parent nodes of node Yi is V(Yi) = V1, V2, ...

The conditional probability of node Yi is:

$$\mathbf{P(Yi\ |U(Yi)) = \frac{P(Yi, U(Yi))}{P(U(Yi))} = \frac{P(Yi = yi, Vi = vi)}{P(Vi{=}vi)}}$$

For node Yi with two parent nodes, the conditional probability is calculated as:

When the parent node is in State1 for example, the conditional probability value that node Yi is in State1 is:

$$P(Yi = State1|V1 = State1, V2 = State1) =$$

$$\frac{P(Yi = State1, V1 = State1, V2 = State1)}{P(V1 = State1, V2 = State1)}$$

In this case, the State1 parameter represents the node's state, and the specific value of it can be used to describe how good the condition of the event (low, medium or high). According to the above formula, a large amount of sample data is required to satisfy the various requirements of each node in order to calculate the conditional probability. The amount of computation grows in proportion to the number of parent nodes. When no exact probability exists, the concept of collective decision-making based on expert experience is required. That is, using the advice of experts on node conditional probabilities via questionnaires and triangular fuzzy numbers for data processing.

2.4 O2O e-business:

O2O commerce is one of the latest retail strategies (sales modes) that combine both online and offline sales. Which has proven effective recently, especially after the COVID-19 pandemic.

The following schemes are the different sales models that could be exist:

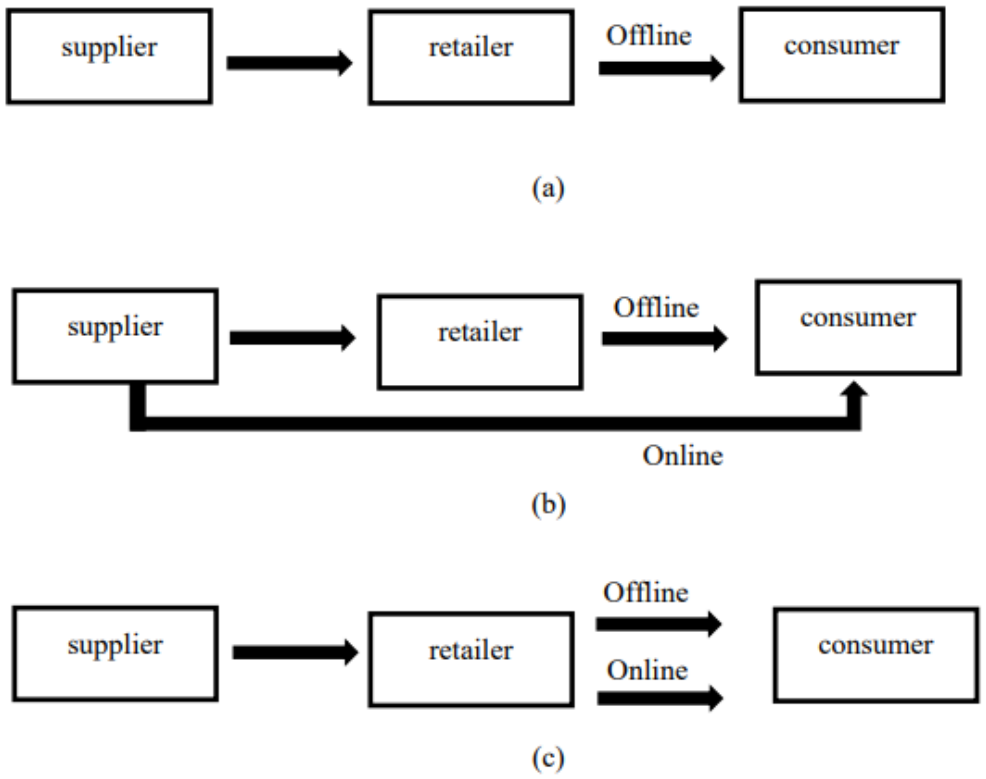


Fig. (2.8): Sales modes (a) Retail mode (b) Dual-channel mode (c) O2O mode

The results of the comparison show that suppliers and retailers have different preferences for sales modality. Suppliers, in particular, prefer the dual-channel mode, but retailers can benefit more from the O2O mode than the other modes. (Yang & Tang, 2019)

Electronic commerce (E-Commerce) means using the Internet to buy, sell, transport, or trade data, goods, or services. (Turban et al,2018)

O2O is a type of e-commerce model that combines offline business opportunities with the Internet in order to bring offline transactions online. (Kang & Kim, 2018)

O2O stands for online to offline, and it refers to offline business opportunities as well as offline business trading via the Internet.

The concept of O2O is very broad, and many industries are currently investigating it. Since then, online E-commerce has decided to use the O2O model, open offline stores, and offline stores have begun to grow the online platform. The industry is mature and has great potential, thanks to the development of logistics and express. O2O goes beyond the industry's narrow definition and can be used in a variety of industries. That is the first transformation and innovation for the entire business environment, and O2O valves are used in the structure of the industry chain as well as consumer devices. Enterprise operations are evolving from a single win to a win-win situation, led by O2O. (Xu & Zhang, 2015)

Barriers to entry into the O2O services market are low compared to other types of companies because they do not require a large investment in physical infrastructure. As a result, the market is fiercely competitive. (Kang & Kim, 2018)

In other words, it’s a business model that enables individuals and businesses to buy and sell goods and services over the Internet. This is regarded as a highly destructive technology. In a nutshell, it's a breakthrough that will change the way consumers, industries, or businesses operate. Disruptive technology has exceptional properties for eradicating obsolete systems and habits.[1],[2]

[1] Bloomenthal, A., 2021. Electronic Commerce (ecommerce) Definition. [online] Investopedia. Available at: <https://www.investopedia.com/terms/e/ecommerce.asp> [Accessed 16 December 2021].
[2] Smith, T., 2021. What Is Disruptive Technology?. [online] Investopedia. Available at: <https://www.investopedia.com/terms/d/disruptive-technology.asp> [Accessed 16 December 2021].

Using the internet to do business is a great development in commerce.

E-Commerce has many types:

1. Business-to-Business (B2B): which refers to the transactions (buying and selling) between and among organizations like businesses selling a good or service to another business, such as a manufacturer and wholesaler, or a wholesaler and a retailer. This type makes about 85% of E-commerce today.
2. Business-to-Consumer (B2C): This includes retail transactions of products or services from businesses to individual shoppers like a consumer buying from an online retailer.[1]
3. Consumer-to-Business (C2B): allow individuals to sell goods and services to the company. In this e-commerce model, a site can invite businesses to bid on opportunities by posting what customers want to do.[2]
4. Consumer-to-Consumer(C2C): This business model is used by consumers to sell used goods and services to other consumers through a digital environment. Transactions here are made through a third-party platform.[3]

[1] Vande Zande, J., n.d. What is e-commerce? Definition, benefits, examples. [online] The Future of Customer Engagement and Experience. Available at: <https://www.the-future-of-commerce.com/2020/01/19/what-is-e-commerce-definition-examples/> [Accessed 16 December 2021].
[2] BigCommerce. n.d. Ecommerce Business Models: Types + What to Select. [online] Available at: <https://www.bigcommerce.com/articles/ecommerce/types-of-business-models/#four-traditional-types-of-ecommerce-business-models> [Accessed 16 December 2021].
[3] India Filings. n.d. Types of E-Commerce. [online] Available at: <https://www.indiafilings.com/learn/types-of-e-commerce/> [Accessed 16 December 2021].

E-business is a broader definition that describes business preparations that organizations do for their structures, processes, and services to maximize the benefits obtained through the internet. (Jackson et al, 2003)

The important traits of an E-business are:

1. Greater use of new technologies in processing data.
2. Increasing the integration of databases and devices because of the open protocols for transferring data between systems.
3. Interactive engagement of people with systems and services such as buying goods and checking orders.

Because e-business is a broader definition of E-Commerce so, it is concerned about many things not just buying and selling goods and services, all online businesses like servicing the customers, collaborating and participating with business partners, and transacting information within the organization. (Turban et al, 2018)

Types of organizations and companies:

1. Purely physical organizations (companies) are referred to as businesses that only use the old style.
2. Purely virtual organizations (companies) refer to the business using only E-commerce.

3. Organizations that conduct some E-Commerce activities physical to virtual or virtual to physical (online to offline O2O) organizations.

The last type of organization is very common and important because it is joining between the physical shops and the virtual world.

O2O commerce, also known as "online to offline" commerce, is a business strategy that encourages potential customers to make purchases through physical sales channels by attracting them from online sales channels to conduct business. It collects information from online customers who have reserved digital systems and directs them to use offline channels such as phone and business.[1]

O2O commerce is a relatively new form of e-commerce that has emerged recently. It is a natural combination of online and offline channels for the sale of different market products. O2O Commerce improves both online and offline connections. This creates new opportunities for the growth of various industries and propels e-commerce to new heights. (Zhang et al, 2020)

Measuring and monitoring the quality of e-business is important for now, as e-business is a great way for companies to enter new markets. Quality improvement, development, and global standardization are essential for e-business customers, leading to the expansion of e-commerce from developed to developing countries, and quality control practices suitable for e-business expansion. (Cristina et al, 2017; Jeong & Song, 2016)

[1] Confer With. n.d. What is O2O strategy? How can it Benefit Brands?. [online] Available at: <https://conferwith.io/knowledge-base/o2o/what-is-the-o2o-strategy/> [Accessed 4 January 2022].

The O2O e-business developed in China as it is start focusing on quality, the safety of food, and diversity not just on quantity. (Zhao et al, 2021)

It is critical to achieving integration between real shops and internet shops in the food industry (particularly products reliant on agricultural resources) through the use of O2O to reduce operating costs and improve the response of the supply chain of agricultural resources used in food industries. (Li,2017)

Internal and external specificities of O2O business, the most important specificities that must be considered customer focus, the ultimate need for development, the need to show information in a very clear and attractive way, more efforts needed to support the feedback mechanism and management difficulties, for the external specificities the need for a stable internet connection and the need of continuous development in the industry or higher technology. (Chentao &Yongle,2014)

O2O is an internet-based platform. The store operator, who operates the O2O platform, provides offline shop information such as discounts, information, and services to Internet users in the O2O e-commerce model. Online payments enable consumers to access product information and purchase products and services. Platform Design O2O refers to a service-based type that includes services that provide information online or that facilitate transactions and purchases of numerous different offline services. Food Distribution O2O can be defined as an O2O service that enables win-win growth by transmitting

information via a virtual environment connection, which is an O2O platform. (Kang et al, 2021)

The most important factor that affects the adoption of O2O e-business is the capability of the company, where the internal factors are the most important ones the company ability to adopt new things, the skills of the workers, and the managers skills and capabilities to identify chances and opportunities and take the advantages of technology solutions. (Latini,2019)

Companies get a lot of benefits because of online business because this decreases the costs of ads and labor charges which needed in offline shops, so it’s important to connect between the virtual world and the physical world by O2O commerce to get all benefits from the new technologies. (Sarkar et al, 2021; Tsai et al, 2015)

Before creating the goods, the manufacturer should consider whether or not the buyers would accept it. At the same time, every consumer has preferences for goods, therefore the factory should consider manufacturing for multiple tastes, for example. When customers buy a product, they don't just look at the product quality; they also want to have a positive experience, which is something they should be aware of before they buy. Attractive product marketing makes buyers consider the product and its quality, as well as the value it may provide, which implies it impacts customers. (Kemp,2006)

A lot of people chose to buy from the internet because of good features and services on consumers like elasticity and flexibility of accessing in any time and place, in the same time there is a lot of choices for the customers which mean this will make it harder for the companies to compete in this digital space so the companies need to build confidence with their customers to encourage to be loyal and not switch to another competitor. (Lie et al, 2019; Zhang & Wang, 2021)

This business model allows users to save money. Customers may not have a clear idea of the number of products they want to buy, or the platform may not provide accurate information. In addition, O2O commerce can reach customers deeper. When a customer places an order on a platform that uses the O2O business model, the purchase data is retained in system memory to provide the customer with customized service. (Cavetti, 2018)

2.5 Quality of food in O2O e-business:

The quality term is usually used in different ways to describe a product or service that satisfy or exceeds expectations. So, when a product or a service is greater than our expectations or exceeds it, that is considered quality. Therefore, quality is based on perceptions which means it’s intangible and impalpable. Quality could be evaluated by the comparison between the performance and the expectations. (Bestwerfield,2019)

In other words, quality can be defined as reaching expectations or better than that exceeding them and meeting customer requirements, so customers define the quality and it's related to creating customer value. (Knowles,2011)

In food shopping behavior theory in e-commerce, there are four categories: (Wang, 2020)

1. Food selection motivation like the taste, food quality, and food variety.
2. Social demographics like gender and age.
3. Characteristics of innovation adoption like the perceived social norm and perceived relative advantage
4. Application service quality like the application design and information quality.

When customer prefers higher food quality, the restaurant will raise the food quality level. Restaurants, especially top restaurants, adapt their food quality decisions to better reflect changes in customer preferences. As a result, customer behavior has a significant impact on restaurant decisions regarding food quality. Changes in delivery terms by the online platform can have a significant impact on customer waiting times and restaurant location decisions. Therefore, the online platform plays an important role in market performance. The best restaurants are generally characterized by high-quality food and high decision-making uncertainty. (He et al, 2018)

Food Quality: the product traits that add value to consumers.

Food quality traits can be bad, such as damage, pollution, fraud, or food safety issues, or good, such as color, flavor, and texture. But the most important quality trait is safety, so there are many food safety standards that factories must follow around the world, beginning with selecting a good raw material and storing it correctly, using clean equipment to prepare food, and checking to ensure that everything is done at the proper temperature. (NCERT,2009)

Food quality is the quality trait of food that appeals to consumers and suits their tastes. Which includes the appearance, texture, and flavor of the products.
Because the firm competes in a highly competitive worldwide context, and clients demand quality, quality is extremely crucial. They need not just a competitive advantage, but also distinctive abilities to survive. This one-of-a-kind expertise might be quality. Quality is also crucial for lowering labor expenses. Quality is undoubtedly an essential part of the food sector, which works in a worldwide market. Companies must establish proper internal structures and devise competitive tactics to achieve this goal. (Liboreiro Paiva, 2013)

The quality of food depends on the consumer perception so differs from one consumer to another, some people look for health more so they rely on the freshness, taste, and appearance of their food which are biological determinants, whereas others look to the economic benefits so they chose food according to the price. Also, there are other determinants that also affect the choice of food quality such as culture, family, and meal patterns, and some psychological determinants there are some people who believe that

food will help them to cope with stress and rise their mood.[1] (Petrescu et al, 2020; Bartkiene et al, 2019)

To better understand how customers evaluate food quality, many statistical methodologies have been employed. Descriptive statistics, bivariate analysis, and regression analysis were all provided. The conclusion was reached that the economic benefits of food purchasing techniques are added to customer quality judgments. Food quality awareness influences dietary habits and has an implicit impact on health at both the individual and society levels. Consumer decision influences the environmental effect of the whole food chain, from farms to garbage cans. (Petrescu et al,2020)

The online and the offline channels should improve and develop the technology and distribution strategies of the food quality information service level.
If any company wants to sell by O2O there is a need for continual development and improvement for their products quality and the system of information services also must be kept up to date in terms of technology, distribution, and business strategies to maintain a high level of quality. (Yu & Ren, 2018)

The pricing decisions of food companies based on the O2O mode were examined, as well as the price impact of food quality information services. If the amount of food quality information service provided by the online channel is certain and the level of food quality

[1] Eufic.org. 2006. The Factors That Influence Our Food Choices. [online] Available at: <https://www.eufic.org/en/healthy-living/article/the-determinants-of-food-choice> [Accessed 8 January 2022].

information service provided by the offline channel is less than the critical value, food manufacturers should employ centralized price decision making. (Yu & Ren, 2018)

The goal of fresh food supply analysis in O2O mode is to identify the elements that impact fresh food quality during the delivery process. Through a complete breakdown of the supply chain and a clear analysis of the specific production process, the supply chain and food quality and safety factor such as storage, distribution, processing, counting, distribution, unloading level, warehousing management, and so on. Other key quality-influencing variables are retrieved. (Zhang et al,2020)

The food business (particularly the dairy industry) is undergoing considerable problems, like: (Okpala & Korzeniowska, 2021)

1. Raw milk is extremely perishable.
2. Differences in the quality of raw materials (raw milk).
3. Processing technologies.
4. Batch volume reduction.

Other factors that affect dairy products quality / safety include: Inappropriate storage of the products and unsuitable temperatures levels.

It is vital to minimize flavor flaws in milk in order to keep it fresh, which can be created by a variety of processes and at various stages along the marketing chain, from farm to

consumer. As a result, new processing procedures and packaging materials to eliminate these undesired off-flavors' have been created. (Molina et al, 2009)

Everyone including the factory, suppliers, wholesalers and retailers are responsible to comply food quality and safety requirements.

Milk is a pleasant and gratifying food when it is produced and processed properly. As a consequence, the milk is analyzed in the following areas: (Molina et al, 2009)

1. Farm milk production: raw milk regulation (effect of forages used in cow feed, health, and herd environment).
2. Processing: the impact of processing procedures on the end product (heating temperature and duration), the impact of packaging materials, and batch consistency.
3. Marketing: assesses customer preferences, examines whether or not consumers can perceive changes between items, and creates unique value-added food products.

2.6 Quality Management in the food industry:

Quality Management is the act of overseeing the different inputs including activities, tasks, and processes within an organization to ensure that the created products or services (outputs) are held to a high and consistent standard, helping to achieve and maintain a desired level of quality within the organization.

In a nutshell, quality management is the process of overseeing all of the activities and responsibilities required to maintain a continuous degree of excellence inside a business. Quality Management has four components: quality planning, quality assurance, quality control, and quality improvement. The process of implementing all four components in an organization is referred to as Total Quality Management (TQM).[1,2]

Quality planning: is a structured process for developing products whether its goods or services to ensure that the final product meet the customer's needs. Using the suitable methods and tools that match the new technological methods which used to develop and deliver the specific product we need. (Juran & Godfrey, 1998)

Quality control: is a process used to evaluate the actual performance and compare it to the stated goals. (Juran & Godfrey, 1998)

Quality assurance: is the comparison between the actual result of the product and the plan (design) to see if the final result met the requirements. (Juran & Godfrey, 1998)

Quality assurance and control both evaluate performance by comparing performance to goals. However, quality control's primary purpose is to maintain control which means during operations the performance must be evaluated and compared to goals.
But in quality assurance, the performance is evaluated after operations. (Juran & Godfrey, 1998)

[1] Industries.veeva.com. n.d. What is Quality Management? The Ultimate Guide | Veeva Industries. [online] Available at: <https://www.industries.veeva.com/ultimate-guide-to-quality-management> [Accessed 10 January 2022].
[2] CFI team, 2022. Quality Management. [online] Corporate Finance Institute. Available at: <https://corporatefinanceinstitute.com/resources/knowledge/strategy/quality-management/> [Accessed 10 January 2022].

Quality Improvement: is the continuous development to improve the reliability of the process and products. (Juran & Godfrey, 1998)

Quality management combines everyone participating in the manufacturing process's dedication, discipline, and developing commitment with fundamental management and control procedures to continually enhance all processes. To do this, you must construct your industry methodically, create rules and quality programs, monitor client satisfaction, and employ more quality tools and procedures. This comprises knowledge and implementation of technology as well as initiatives linked to product safety, which is especially important in the food business. (Liboreire Paiva, 2013)

In the food sector, quality management is very important to determine if the product is produced correctly so that the consumer is ready to pay for it, which implies doing all activities at a high degree of perfection. This entails establishing a clear quality strategy, implementing and developing quality planning, quality control, quality assurance, and quality improvement.

Food quality management is concerned with how food quality may be attained. It includes goal-oriented decisions that lead to activities that assist to achieve or surpass customer and consumer quality criteria.

Quality planning in the food industry means creating and refining the systems and procedures required to create goods that meet and exceed consumer expectations. The organization must first establish who its customers are, what their needs, and then build the systems and procedures to suit those demands.

Quality control in the food industry involves analyzing and monitoring all elements, processes, and operations involved in production to ensure that everything works smoothly and satisfies the standards, as well as testing to ensure that all phases and process outcomes are reliable.

Quality assurance in the food industry means ensuring that the finished product satisfies the specifications established during the quality planning step. To avoid any errors, measurements and comparisons with standards are used.

In general, quality assurance practices are measured by: (Ali & Talib, 2010)

1. Processes for reviewing new product designs.
2. Develop manufacturing techniques.
3. Product and labor specifications, as well as procedure management.
4. Increase preventative maintenance efforts.
5. Quality control actions are carried out across the value chain.

Quality improvement in the food industry entails initiating a mechanism to evaluate, develop, and improve processes and products while keeping efficiency, dependability, effectiveness, and flexibility in mind. This can be accomplished through quick and significant changes or through consistent and continuous improvement. Food quality management is complicated because it addresses unpredictability, limited shelf life, and the varied characteristics of foods and raw materials as a result of a variety of chemical, physical, and microbiological activities (organic). The food supply chain is similarly

complicated, with several linkages. Furthermore, many individuals are employed in industrial operations along the food supply chain. As a result, human behavior is vital in uncertain and changing therapy.

Food quality management strives to achieve food quality that meets or exceeds the expectations of customers and consumers. Current agricultural food sector practices are centered on control mechanisms, which necessitate predictable food and human systems. Forecasts in food quality management are based on the dynamic behavior of food and human systems. (Luning & Marcelis, 2007)

Based on the Study and analysis, the following can be determined: (Zimon, 2017)

1. A quality management system has a favorable impact on the food supply chain, particularly in areas such as enhancing supplier collaboration and customer logistics. Care and simplification in quality control.
2. The deployment of a quality management system should be based on a well-chosen plan that allows for increased efficiency and effectiveness.
3. The quality management system has the least influence on enhancing procedures that are directly tied to the actual product flow.

Furthermore, given the unique nature of the food supply chain and the influence on product quality that all parties involved have, sophisticated quality solutions in the food supply chain are required. (Zimon, 2017)

Implementing a highly Sophisticated integrated food quality and safety management system is expensive, has limited employees and time, and lacks expertise and experience in general. A key impediment is the scarcity of human resources.

Food quality and food safety are frequently used interchangeably. (Khatoon et al, 2017)

The primary goal of the food safety system is to identify and prevent dangers that might lead to product degradation. It is critical to understand how systems contribute to overall product quality and to balance the instruments utilized to achieve quality and safety objectives. Food items go through the supply chain at all levels (production, storage, and distribution). (Khatoon et al, 2017)

The food industry's quality management discipline uses a variety of terminologies and acronyms, including HACCP, ISO, and many more.

Hazard Analysis and Critical Control Points (HACCP): a preventative approach to food safety during the manufacturing process that involves a system of hazard detection, evaluation, and control. which refers to a dedication to producing or trading safe food. (Kumar, n.d.)

In other words, HACCP is a strategy for food production and storage that ensures raw materials are safe as well as every stage in the manufacturing process is safe, has no food hazards, and has no risk of developing them. (NCERT, 2009)

In the dairy business, the HACCP approach is frequently employed. HACCP is a rational, effective, science-based, highly organized food safety management approach that assists

HACCP team develop programs at facilities in minimizing, managing, or controlling risks. (Sayler, 2009)

The HACCP system has proven to be a highly beneficial tool for managers, allowing them to automatically integrate HACCP principles in the workplace.
HACCP helps companies by lowering the expenses associated with food safety issues. Furthermore, HACCP puts additional costs on the food sector while simultaneously acting as a business management tool, which may improve a company's export performance. (Rosak-Szyrocka & Abbase, 2020)

The following are some of the advantages of incorporating the HACCP system: (Rosak-Szyrocka & Abbase, 2020)

1. Use scientifically validated food safety data and principles.
2. The emphasis is on prevention, which ensures a high level of safety.
3. It satisfies customer requirements and expectations while also increasing consumer trust in dairy goods.
4. The integrity of the brand has been preserved, and the number of consumer complaints has decreased.
5. Increase your chances of selling.

It is critical to use HACCP to:

Guarantee food safety, the detection of hazards at any step of manufacturing to ensure product quality, assists manufacturers in making efficient and effective use of resources. (NCERT, 2009)

Principles of HACCP: (New Zealand Government,2018)

1. Analyze the hazards. Identify the biological, chemical, and physical risks for each process stage.
2. Determine the critical control point (CCP) and the mechanism of control.
3. Set crucial limits for each CCP.
4. Create a mechanism for monitoring CCP.
5. Determines whether or not remedial action should be performed if surveillance reveals that a certain CCP is out of control.
6. Create a technique for verifying that the control system is operational.
7. Create a document that includes all processes and records relevant to the HACCP principles and their implementation.

The ISO 9000 family of standards, which includes some of the most well-known ISO standards, consider many areas of quality control. These standards are the tools that businesses and organizations require to assure product and service consistency, fulfill customer expectations, and constantly improve the overall quality of the company

Many standards are part of the ISO 9000 family, including: (Kumar, n.d.; Will & Guenther,2007; Kotsanopoulos & Arvanitoyannis, 2017)

1. The ISO 9001:2015 quality management system criteria are met.
2. ISO 9000: 2015-Basic concepts and languages covered.
3. ISO 9004:2009 focuses on enhancing the efficiency and effectiveness of quality management systems.
4. ISO 19011:2011 - Internal and external auditing guidelines.

ISO 9000/9001: International quality management and assurance standards for the industry that improve organizational operations and thereby increase customer satisfaction. (Kumar, n.d.)

The quality management standards encompass all of the principles and regulations that guarantee goods continually achieving an anticipated level of quality. (Kumar, n.d.; Will & Guenther,2007)

The International Organization for Standardization (ISO) provides the quality management standards listed above. It is widely recognized and utilized all throughout the world. ISO9001 is one of the most extensively utilized ISO standards. The ISO 9000 set of standards offers enterprises with quality management rules and tools. Anyone who wants to ensure that their products and services fulfill the needs of their customers. (Lachapelle et al, 2015)

ISO 9001: 2015 developed into quality management standards, which includes: (Lachapelle et al, 2015)

1. Process techniques, risk management, performance, and indicator monitoring are given more attention.
2. Better Attention to stakeholders.
3. To assure quality improvement, a more thorough examination of the organizational environment is required.

According to research and comparisons of the best food companies that have received quality awards, there should be eight quality management practices in the company to be successful: leadership, corporate planning, human resource management, information management, customer focus, supplier focus, process management, and quality assurances. (Talib et al,2013)

Varied company sizes place different emphasis on quality management strategies. Small businesses prioritize process management and customer attention, whereas medium businesses prioritize process management and leadership, and giant businesses prioritize leadership components. All of this implies that small and medium-sized businesses outperform giant corporations in terms of quality management and customer focus. (Kim-soon et al,2020)

Quality management tools are used to establish, measure, and provide solutions that assist firms in collecting and analyzing data that aids in the proper execution of work processes and helps employees comprehend information interpretation. It's a strategy. We need to carefully monitor and assess input and expectations in order to produce the best quality products.[1] Many businesses confront difficulties as a result of a lack of knowledge and training in quality management techniques. (Paiva et al,2019)

It has been noted, that many small businesses do not prioritize food quality and safety because they are more concerned with profits. (Nordenskjöld,2012)
Food quality and safety policy lead to:

1. Improve the final product's quality and safety.
2. HACCP management ensures legality as well as food safety.
3. Maintain a system of continuous improvement for the quality and food safety of our goods, processes, services, and management system as a whole.

Efforts to food safety and quality include: (Technews,2008; Velázquez-Ordoñez,et al ,2019)

1. Food safety refers to the production and distribution of safe and high-quality food.
2. Consumer Health: Produces and distributes healthful dairy products.

[1] Managementstudyguide.com. n.d. Quality Management Tools. [online] Available at: <https://www.managementstudyguide.com/quality-management-tools.htm> [Accessed 15 January 2022].

3. Consumer Satisfaction: The objective is to continually meet and exceed the expectations of customers and consumers.

Food safety and quality system levels: (Technews,2008)

1. Food Safety Basics.
2. A Food Safety Plan Based on HACCP Certification.
3. System of Comprehensive Food Safety and Quality Control.

Food safety and quality systems come in many forms: (Kotsanopoulos & Arvanitoyannis, 2017)

1. ISO9000 and other voluntary worldwide quality assurance standards developed by the private sector.
2. Farm-level protection measures at the national level, such as Farm Assured British Pigs.
3. The UK's largest food retail businesses maintain a one-of-a-kind quality assurance system.

The perceived usefulness, perceived value, perceived usability, fear of mobile, Price, Trust, Food Diversity, Apps-Design, Convenience, Pleasure Motivation, Social Codes, Online Shopping Experience, Household Size, Food Quality, Delivery Efficiency, Information Quality are all factors to consider when shopping for groceries using O2O

delivery. Consumer views, motives, attitudes, category preferences, and behaviors regarding e-commerce grocery purchases are not well understood. (Wang et al, 2020)

2.6.1 Quality of milk:

The first step in ensuring dairy product safety and health is ensuring the quality of milk production. It is essential that supply chain actors such as non-governmental organizations, government agencies, and recycling companies provide support. Small dairy farms are committed to adhering to milk quality standards and improving milk handling. When it comes to milk quality, the focus is entirely on prevention. Quality management systems are designed to prevent defects, not detect them. Because it is an agricultural product, quality control is carried out at all stages of production. Consumers, processors and regulators are increasingly concerned about the safety and integrity of milk as they place greater emphasis on farm management to ensure milk quality. Despite advances in milk processing technology, the quality of milk is still determined by the dairy farm. High quality milk is a milk produced according to the specified standards, bacterial levels, somatic cell counts, milk fat, protein, and other measurements depending on the management strategies implemented in the milking parlor. (Nyokabi et al, 2021; Karakök, 2007)

In order to prevent bacterial and chemical contamination and generate high-quality products, the dairy sector must implement programs to control food safety and raw milk

quality. Maintaining hygienic procedures in the cow farm and keeping the milk properly in the raw milk tank are two ways to reduce dairy product contamination.

The dairy sector is moving toward safer milk and dairy products in the food market. Food Safety and Milk Quality Concerns regarding consumer health and nutrition in public health monitoring of risk food-borne illnesses can help to avoid food poisoning and food-borne illnesses from raw milk and fresh dairy products. (Velázquez-Ordoñez et al, 2019)

Farmers, dairies, and customers all benefit from hygienic milk production on the farm. For farmers, sanitary milk production is important not just for tank milk quality but also for animal welfare. Different management strategies are used because diverse microorganisms have different origins. As a result, the production of hygienic milk requires a number of criteria. Farm management includes everything from animal care and feed management to massive barn construction. (Vissers & Driehuis,2009)

To prevent the accumulation of water and milk residues, milk tankers and spill locations should be cleaned and disinfected. To obtain safe and high-quality dairy products, high-quality raw milk must first be obtained. Raw milk should be tested in the lab using excellent lab-quality assessment standards by performing several tests. The different assessment methods of raw milk:[1] (Keskin & Gulsunoglu, 2012)

[1] White, C., 2016. Dairy Foods. [online] Dairyfoods.com. Available at: <https://www.dairyfoods.com/articles/91832-the-16-tests-you-need-to-perform-on-raw-milk-finished-products> [Accessed 3 March 2022].

1. Use a validated fast method to indicate the microbiological quality of raw milk.
2. Measure the temperature of raw milk, with 10°C as the upper limit, because the greater the temperature, the more bacteria proliferate.
3. Performing a milk composition test should be done throughout the process to ensure that fat management and identity criteria are met. By using electronic tools, the facility can achieve fast and accurate results.
4. Monitor the surrounding area for the presence of Listeria monocytogenes in all other dairy products especially liquid milk. with an effective HACCP program and successful implementation of food prevention management for people.
5. Measuring the PH value and titratable acidity.

Some of the most critical milk quality criteria to assure dairy product safety are:(Karakök, 2007)

1. Content quality and physicochemical status of milk like fat and protein
2. Hygiene quality has indicators like bacteriological and cytological properties, absence of pathogens and other contaminants.
3. Sensory quality which influences the customers directly could be defined by the texture, taste, aroma, and visual aspects. In milk, sensory traits are strongly influenced by fat content.
4. Nutritional quality is the value of the product for the consumer's physical health, growth etc. (Köpke, 2005)
5. Technical quality (processing power).

The following are some examples of efficient dairy quality management activities, derived from baking sector: (Van der Spiegel et al, 2006)

1. Strategic management.
    - This process determines how to achieve the organization's mission and goals (Analysis of the long-term strategy).
2. Assigning of raw material suppliers.
    - Raw Material Purchase allocation.
    - Suppliers Selection Allocation.
3. Supply control:
    - Raw materials purchase and selection.
    - Supplier selection and evaluation.
4. Production control:
    - Product and process management.
    - Process improvement.
5. Control of production task execution:
    - Information, instructions, and support.
    - Evaluation of results.
6. Management of receiving orders:
    - Order Analysis, Acceptance, Processing
7. Distribution plan:
    - Development and evaluation.

The supply chain network is a collective strategy and Overall chain management. Chain management must include relationships. Interdependence of member companies, corporate problems level, two-dimensional level, and network level. The operating chain quality management system prioritizes reducing health risks associated with food contamination. ISO and other chain adaptive standardization systems are used for this purpose. Chain of Quality Management Strategy considers additional quality attributes that are reliability characteristics as a result, the focus company's challenge is to choose the quality approach that is best suited to the overall network goals and characteristics. (Hanf & Pieniądz, 2007).

Supply chain quality management is the method through which firms measure, monitor, and control the quality of their supply chain's goods and operations. Used to increase on-time delivery and build more consistent supply chains.[1]

The factors affecting the quality of dairy products have an impact on O2O quality testing requirements. This integrated system represents the many components of the O2O environment of the fresh dairy production facility and serves as a direct foundation for quality management. As a result, a system of scientific analysis and assessment must be developed. A complete indicator system for evaluating the quality of dairy products in the O2O model was developed taking into consideration customer wants and requirements

[1] Tracelink. n.d. Supply Chain Quality Management. [online] Available at: <https://www.tracelink.com/agile-supply-chain/supply-chain-quality-management> [Accessed 8 March 2022].

from product preparation through producing (manufacturing)and distribution processing, sorting, and delivery links (transportation connections). (Zhang et al, 2020)

2.6.2 The supply chain of the dairy industry in Palestine:

As we knew from the dairy factories. The journey of the dairy products begins in the farm, lab, and factory and finally ends with it being distributed.

Farm: every factory had its own farm where cows are raised for milk collection, and raw milk could be purchased from local farms.

Lab: The raw milk sent from the farm to the factory is first tested in lab to ensure that it fulfills the Standards.

If the raw milk satisfies the standards, it will be processed to make various dairy products, which will subsequently be delivered to the markets.

In the next figure, the supply chain is illustrated.

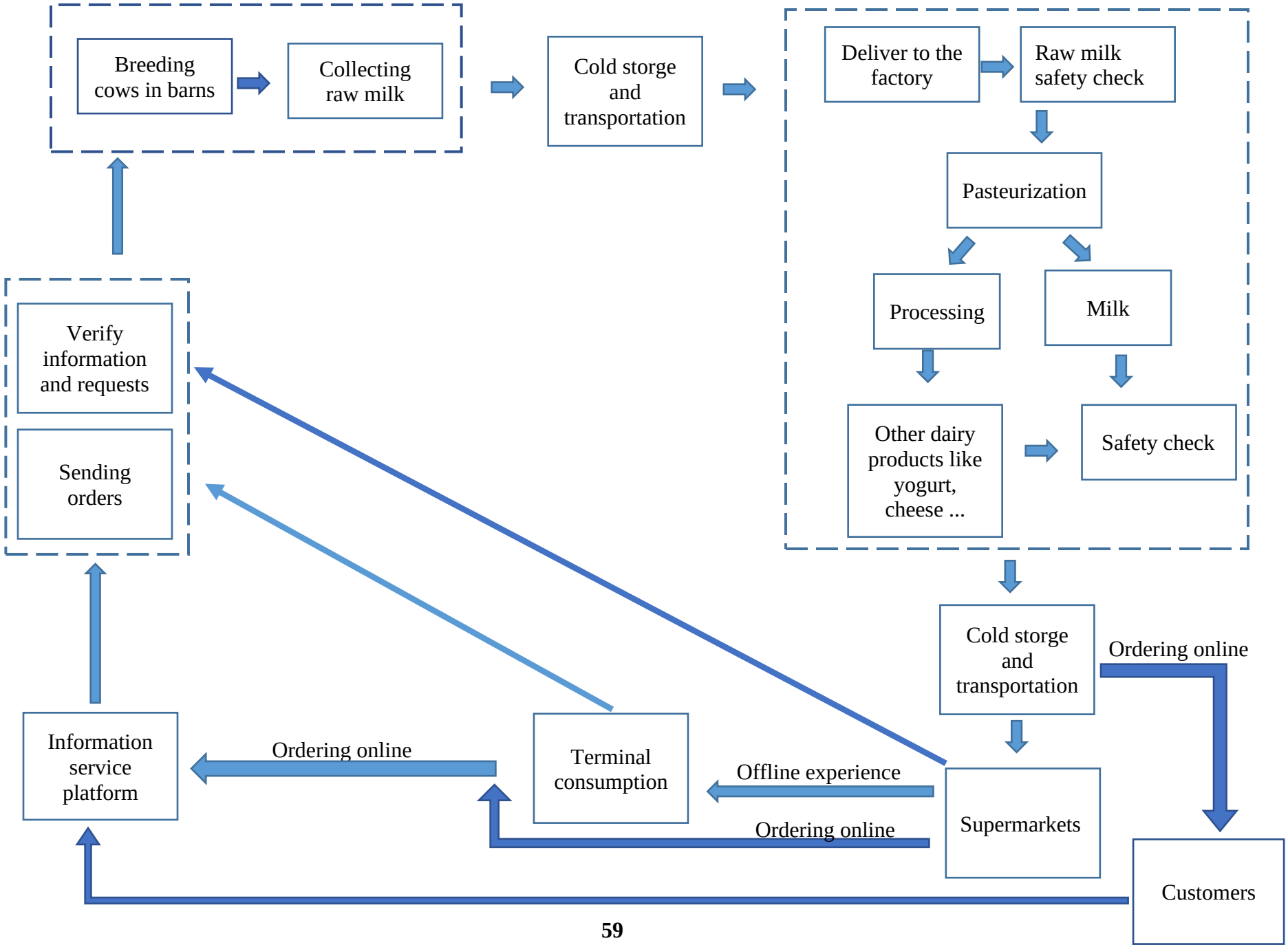


Fig. (2.9): Supply process for dairy products in the O2O mode (Zhang et al,2020)

2.6.3 The stages of milk production

Preparation for goods (Production of raw milk at farm) (Zhang et al,2020)

The safety of raw milk may be jeopardized if recipients fail to fulfill basic visual inspection and vehicle temperature records. Containers and tanks must be cleaned on time otherwise raw milk will spoil and germs and bacteria will proliferate.

After careful consideration, the primary factors influencing raw milk quality may be classified as follows: Acceptance inspection, barns inspection, purchase plan, collecting milk, unloading, receiving, and monitoring the barns.

Producing and distribution processing (Production stage) (Zhang et al,2020)

According to the Health Protection Agency, workplaces must be disinfected and cleaned in strict accordance with national food hygiene criteria as well as related laws and regulations.

As a result, the process of milk production and distribution is primarily influenced by the following factors: Storing raw milk in coolers, raw milk pasteurization, cleaning and cooling after pasteurization, packing (filling bottles, cartons, jars…), refrigeration and transportation.

Sorting process (controlling process) (Zhang et al,2020)

This is a key step in the distribution of dairy products. Allocation checks are intended to assure high-quality dairy products; however, inspection mistakes result in poor dairy products throughout the delivery channel, which degrades dairy goods.

As a result, the sorting procedure of each operation affects the quality of dairy products differently. This is primarily reflected in the sorting, allocation inspection, and final packaging.

Delivery links: (Zhang et al,2020)

Delivery amount, facilities, delivery routes, and distribution center locations all influence delivery time.

Factors affecting the safety of dairy products, in particular, must be considered throughout the loading process. Varied loading equipment has different effects on the quality and safety of dairy products, and the loading method affects dairy product temperature management.

Proper loading influences the smooth transportation and unloading of dairy goods, whereas bad loading increases transportation time, impacting the quality and safety of the dairy product.

Failure of temperature control equipment during the transportation process will result in the destruction of dairy products.

The influence of delivery on the quality of fresh dairy products is most visible in the following operations: Delivery plan, delivery notice, outgoing quality control, loading, transportation and logistics, temperature control of the whole-process, and unloading.

This chapter has clarified the concepts and previous studies that dealt with the subject of the research and studied it in whole or in part, as many previous studies dealt with quality management and quality management in the field of dairy and also e-business, in the next chapter it will be clarified how this research studied the subject and measure it.

2.7 Literature Review

1. Sarkar et al, 2018: This research develops a model for an O2O supply chain management network for a small-scale household electric component manufacturer delivering goods to distribution centers and retailers. Throughout this paper, it is assumed that all connections between the sending and receiving nodes are active. A variety of delivery vehicles are required for product transportation between the parties involved.

   The family O2O supply chain management model was developed as a result of this study. Manufacturer of electrical components that ships to distribution centers and retailers. Customers of products acquired through investments in O2O e-business are these multi-retailers.

2. Zhu et al, 2022: Community-based O2O e-commerce creates a new O2O integrated business model in the post-epidemic era. The study's findings were as follows: Subjective norms and structural assurance in social factors both influence consumers' intentions to continue using a product. Customers' intentions to return are influenced not only by the level of convenience and safety in platform factors.

Customers' perceived value serves as a mediator between customer-enterprise co-creation behavior and consumer willingness to use. This paper employs a quantitative or structured approach via a questionnaire. A total of 310 completed questionnaires were examined.

3. Lucci et al, 2014: We built a Bayesian Network to represent the relationships among variables and the potential success or failure of various strategies and site conditions affecting total phosphorus exports from dairy farms in New Zealand's south Otago region.

   Annual rainfall, farm slope, and the proportion of overland and subsurface flow were discovered to have the greatest influence on total phosphorus loads exported from dairy farms. Farmers in this region should pay special attention to hilly or steep farm areas, according to the Bayesian Network, by maintaining Olsen P levels in the target range, grazing cows at lower stocking rates, and following other best management practices.

4. Baudrit et al, 2009: The purpose of this paper is to propose a simplified representation of the entire ripening process of a soft mold cheese using dynamic Bayesian networks. Based on expert knowledge, we created the first dynamic Bayesian network, which allowed us to describe a network of interactions between variables at different scales during the ripening of a soft mold cheese.

5. Mrad et al, 2011: This paper proposes a reliability inference algorithm based on Bayesian networks and fuzzy logic. Fuzzy Evidence in Bayesian Networks is an approach that combines Fuzzy Logic and Bayesian Networks. This has allowed us to reap the benefits of these two approaches while overcoming the problem of data and observation uncertainty.

6. Iqbal et al, 2016: Using a novel Bayesian network model approach, this study presented a method for detecting the presence of cattle estrous cycles. The results and analysis confirmed that the proposed Bayesian network model could identify the most accurate and optimum factors for cattle productivity.

7. Sevinç et al, 2020: The purpose of this study is to provide a multilateral analysis of milk yield and three variables all at once (parity, first calving year, and lactation length). The path analysis findings were used to build a Bayesian network for the analysis. From 2001 to 2011, 17,109 Holstein Friesian cow calving records were examined.
   Previous findings of variables and their known relationships can be added to the Bayesian model as "previous information" in the Bayesian network.
   This feature of Bayesian networks allows current data to be used to update previous data findings.

8. Akhmetova & Suleimenova, 2018: The enterprise's strategic development directions for dairy product production are evidence-based, including the

requirement for structuring and improving the process-focused approach to quality management. The conceptual principles that allow for the creation, identification and implementation of an effective dairy enterprise process are defined as a result of research and scientific analysis. The process is outfitted with resources and a management subsystem based on statistical methods and means, and it operates under specific conditions dictated by production needs in order to obtain planned values for the indicators' effectiveness and efficiency.

9. Keskin & Gulsunoglu, 2012: Food security in the dairy industry is dependent on adequate quality and food safety practices. The Hazard Analysis and Critical Control Points (HACCP) system has been identified as one of the most effective methods for ensuring high-quality and safe food. The primary goal of Critical Control Points (CCP) is to identify problems before they occur, establishing critical control measures to maximize food safety at each stage of the manufacturing process. HACCP is a global food safety system that ensures dairy import and export food safety. As a result, a description of the critical points in milk and milk product production processes, as well as the evaluation and orientation used to prevent and control the critical points, were described.

2.8 What distinguishes this study from other studies

After reviewing the previous studies, we discover that the most significant feature of the present research is demonstrated in a number of aspects, the most significant of which are:

1. The majority of previous studies on e-business and O2O were conducted and related to consumer opinion on the topic, and there are other studies on the topic in Electric Power Distribution Systems, but there were no studies on dairy products.
2. The majority of previous studies focused solely on the use of the Bayesian network in dairy pastures and food processing, with no mention of its use in quality management in the dairy industry.
3. None of the previous studies combined all of the study's subjects.

Chapter III

Methodology

3.1 Research Method

3.2 Data Sources

3.3 Research Population

3.4 Research Sample

3.5 Variables Description of Research Sample

3.6 Primary Research Tool

3.7 Test of Validity and Consistency

3.8 Research Procedure

3.9 Statistical Processing Tool used for Questionnaire Analysis

Chapter III

3.1 Research Method

This research will be exploratory because we want to know the application level of quality factors in dairy industries in Palestine, quantitative. To do this research we will need one tool which is the questionnaire.

3.2 Data Sources

The researcher has used two main sources for data collection:

Secondary Sources:

The researcher used secondary data sources such as books, articles, publications, journals, unpublished thesis, and dissertations.

Primary Sources:

The researcher gathered the data for the analytical part by developing a questionnaire. The questionnaire covering the topic of the research, which started with questions related to the stage before sending raw milk to the factory, then the stage after sending raw milk to the factory, where the questions were divided into tables with several sentences according to topics (a table related to quality and its management, a table related to e-commerce and the last one related to the Fuzzy Bayesian network model).

3.3 Research Population:

The research population consists of dairy factories employees in Palestine.

Table (3.1): The largest dairy factories in Palestine

The company	Number of employees
Al-Junaidi Company for Dairy and Food Processing	520
Al-Jebrini Dairy and Foodstuff Company	310
Hamouda Company for Dairy and Foodstuffs	51-200
Al-Binar General Trading Company	Less than 50
Al-Tayf Dairy (Candia)	Unavailable

3.4 Research Sample:

A convenient sample was used from dairy factories in Palestine that produce milk, cheese, and yogurt, and their number is (3) factories. These factories were covered by visiting the factories and inspecting them, regardless of the job title or the structural arrangement of his location. The three dairy factories are:

Al-Jebrini Dairy and Foodstuff Company is one of the largest local dairy companies, which has the largest role in the development of the dairy and food sector in Palestine. More than one hundred and thirty varieties to meet the needs of the local market. In the year 2007, the company established a cow farm, which is considered one of the first model farms in the region, it can accommodate more than four thousand heads of milk-producing cows, in order to provide raw milk to meet the growing market needs, as well as provide high quality Palestinian raw milk.[1]

[1] Al-jebrini company, 2018. [online] Available at: <https://al-jebrini.com/newsite/ar/aboutus.php> [Accessed 31 November 2021].

Al-Junaidi Company for Dairy and Food Processing is considered as one of the leading and first companies in the dairy and food product industries, and it is one of the first companies that also contributed to the development of the livestock and agricultural sector through the establishment of the largest farm for raising cows and producing fresh milk in Palestine and Jordan.[1]

Hamouda Company for Dairy and Foodstuffs is a private limited joint-stock company established in 1989, and it is one of the Hamouda Investment Group companies, located in Jerusalem and is considered one of the largest and leading Palestinian companies in the field of dairy and foodstuff manufacturing. In addition, it contributes greatly to filling the Palestinian market need for Dairy products and their derivatives, and the company relies on its policy on reaching consumer satisfaction by always providing the best and finest dairy products.[2]

3.5 Variables description of research sample:

The following table shows the distribution of the sample relative to the demographic variables of the research:

Table (3.2): Sample Distribution Relative to Personal Questions

The gender		
	Frequency	Percent
Male	18	58.1
Female	13	41.9

[1] www.maannews.net, 2016. الجنيدي للألبان والمواد الغذائية يشارك في معرض غذاؤنا 2016. [online] وكـالـة مـعـا الاخبـارية. Available at: <https://www.maannews.net/news/836240.html> [Accessed 31 November 2021].

[2] Hamoda company, 2020. شركة حمودة. [online] ملتزمون بالجودة. Available at: <https://web.hamoda.ps/hamoda-story/commitment-to-quality/> [Accessed 31 November 2021].

Total	31	100.0
The age		
	Frequency	Percent
Less than 30	19	61.3
30-40	6	19.4
40-50	6	19.4
Total	31	100.0
Years of experience		
	Frequency	Percent
Less than 5	15	48.4
5-10	6	19.4
10-15	4	12.9
More than 15	6	19.4
Total	31	100.0
The Academic degree		
	Frequency	Percent
Secondary and below	1	3.2
Diploma	0	0.0
Bachelor	29	93.5
Master's degree and above	1	3.2
Total	31	100.0
The job title		
	Frequency	Percent
Employee	22	71.0
Manager	4	12.9
Other	5	16.1
Total	31	100.0

3.6 Primary Research Tool:

Questionnaire:

A questionnaire was developed regarding "A Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for food industries in Palestine"

The questionnaire is divided into three sections:

First section: consists of characteristics related to the respondents themselves (Gender, Age, Years of experience, Academic degree and Job title)

Second section: consists of a series of questions about the stage before sending the raw milk to the factory

Third section: consists of a series of questions about the stage after sending the raw milk to the factory, in addition to three sub sections as following:

1. Solutions and ideas proposed to face problems affecting dairy production and increasing its quality.
2. Statements express the possibility of implementing the idea of (O2O e-business)
3. A model (Fuzzy Bayesian Network Model) to study the possibility of quality management in the dairy industry in Palestine

3.7 Test of Validity and Consistency:

Validity of the Tool:

The researcher prepared the thesis in a preliminary manner. The questionnaire was verified by a panel of judges and experts (Names in appendix (B)) and asked for their opinions on the following points: Question clarity, grammar and comprehensiveness of the question.

Consistency of the tool:

Tool consistency was verified by the researcher that used Cronbach's alpha factor to calculate the overall consistency score. Cronbach's alpha score is **0.965** which indicate that the tool is consistent with the objectives of the study.

Table (3.3): Cronbach Alpha for dimensions and total score

Section	Consistency Score
Solutions and ideas proposed to face problems affecting dairy production and increasing its quality.	0.905
Statements express the possibility of implementing the idea of (O2O e-business)	0.839
A model (Fuzzy Bayesian Network Model) to study the possibility of quality management in the dairy industry in Palestine	0.976
Total score	**0.965**

3.8 Research Procedures:

After the researcher validated the research tool through validity and consistency tests, the questionnaire was submitted online and manually, and appropriate samples of **31** respondents to the questionnaire was received and then analyzed using SPSS.

3.9 Statistical Processing Tool used for Questionnaire Analysis:

After collecting the questionnaires and confirming their validity for analysis, they were coded for statistical processing while aligning with the research questions and objectives. The frequencies and percentages for each question were calculated, and Cronbach alpha was calculated to ensure the consistency of the research tool, all of which was done using SPSS.

Chapter IV

Data Analysis and Discussion

4.1. General Results

4.1.1 The number of dairy cows

4.1.2 The number of times that the cows milked daily

4.1.3 Average amount of milk produced per day in liters

4.1.4 Dairy cattle farm and the safety measures

4.1.5 Strategies to increase raw milk production

4.1.6 Types of raw milk production constraints

4.2. Research Questions Results

4.2.1 Results Related to First Sub-question

4.2.2 Results Related to Second Sub-question

4.2.3 Results Related to Third Sub-question

4.2.4 Results Related to Forth Sub-question

4.3. Discussion

Chapter IV

4.1 General Results

The stage before sending the raw milk to the factory (At dairy cattle farm)

4.1.1 The number of dairy cows

Table (4.1): Number of dairy cows

Number of cows	Frequency	Percent
200	6	19.4%
250	3	9.7%
300	1	3.2%
600	3	9.7%
650	3	9.7%
1000	9	29.0%
2000	6	19.4%
Total	31	100.0%

Table (4.2): Statistics for the number of dairy cows

Mean	870.97
Median	650.00
Std. Deviation	641.583
Variance	411629.032
Minimum	200
Maximum	2000

4.1.2 The number of times that the cows milked daily

According to the results, most of the respondents indicated that cows are milked three times a day at 58.1% , meanwhile who answered twice were 41.9% and non for once daily.

Table (4.3): Number of times that cows milked daily

	Frequency	Percent

Once	0	0.0%
Twice	13	41.9%
Three times	18	58.1%
Total	31	100.0%

Table (4.4): Statistics for the number of times that the cows milked daily

Mean	2.58
Median	3.00
Std. Deviation	0.502
Variance	0.252
Minimum	2
Maximum	3

4.1.3 Average amount of milk produced per day in liters

The average quantity of milk varied from 10,000 to 50,000 liters.

Table (4.5): Milk quantity in liters

	Frequency	Percent
10000	9	29.0%
15000	2	6.5%
17000	1	3.2%
17500	1	3.2%
20000	3	9.7%
30000	9	29.0%
50000	6	19.4%
Total	31	100.0%

Table (4.6): Statistics for Milk quantity in liters

Mean	25306.45
Median	20000.00
Std. Deviation	14597.190
Variance	213077956.989
Minimum	10000
Maximum	50000

4.1.4 Dairy cattle farm and the safety measures

Table (4.7): Related to the cow farm and safety measures

Is an automated milking system used?		
	Frequency	Percent
Yes	31	100.0%
No	0	0.0%
Total	31	100.0%
Is manual milking used?		
	Frequency	Percent
Yes	9	29.0%
No	22	71.0%
Total	31	100.0%
Do workers sterilize hands before milking?		
	Frequency	Percent
Yes	31	100.0%
No	0	0.0%
Total	31	100.0%
Is the udder of cows cleaned with iodine before milking?		
	Frequency	Percent
Yes	31	100.0%
No	0	0.0%
Total	31	100.0%
Is milk from different milking times combined before being sent to the factory?		
	Frequency	Percent
Yes	19	61.3%
No	12	38.7%
Total	31	100.0%
Are there plans to increase the proportion of raw milk?		
	Frequency	Percent
Yes	30	96.8%
No	1	3.2%
Total	31	100.0%

The concluded things from the above table: All the factories use automated milking system, just 29% say that they use also manual milking, all these workers sterilize

hands, the udder of cows always cleaned with iodine before milking, 61.3% confirmed that milk from different milking times are combined before sent to the factory and 96.8% confirmed that they have plans to increase the proportion of raw milk.

4.1.5 Strategies to increase raw milk production

Table (4.8): Plans to increase raw milk production

Increasing the number of dairy cows		
	Frequency	Percent
Yes	23	74.2%
No	8	25.8%
Total	31	100.0%
Improvement of cow breeds		
	Frequency	Percent
Yes	24	77.4%
No	7	22.6%
Total	31	100.0%
Produce more feed		
	Frequency	Percent
Yes	9	29.0%
No	22	71.0%
Total	31	100.0%
Buy more feed		
	Frequency	Percent
Yes	8	25.8%
No	23	74.2%
Total	31	100.0%
Use of improved types of feed		
	Frequency	Percent
Yes	12	38.7%
No	19	61.3%
Total	31	100.0%
Focus on confronting and controlling cattle diseases		
	Frequency	Percent

Yes	14	45.2%
No	17	54.8%
Total	31	100.0%
Get more outside advice from the experts		
	Frequency	Percent
Yes	20	64.5%
No	11	35.5%
Total	31	100.0%
I do not know exactly		
	Frequency	Percent
Yes	6	19.4%
No	25	80.6%
Total	31	100.0%
Other		
	Frequency	Percent
Yes	1	3.2%
No	30	96.8%
Total	31	100.0%

To increase raw milk production these the most important steps to do:

1. Improvement of cow breeds.
2. Increasing the number of dairy cows.
3. Get more outside advice from the experts.

4.1.6 Types of raw milk production constraints

Table (4.9): Constraints facing the dairy farms

Low quality forage or bran		
	Frequency	Percent
Yes	12	38.7%
No	19	61.3%
Total	31	100.0%
Low quality concentrated feed		

	Frequency	Percent
Yes	8	25.8%
No	23	74.2%
Total	31	100.0%
High cost of concentrated feed		
	Frequency	Percent
Yes	20	64.5%
No	11	35.5%
Total	31	100.0%
Difficulty buying new cows		
	Frequency	Percent
Yes	12	38.7%
No	19	61.3%
Total	31	100.0%
Agricultural labor shortage		
	Frequency	Percent
Yes	18	58.1%
No	13	41.9%
Total	31	100.0%
Low milk quality		
	Frequency	Percent
Yes	4	12.9%
No	27	87.1%
Total	31	100.0%
Low milk yield		
	Frequency	Percent
Yes	9	29.0%
No	22	71.0%
Total	31	100.0%
Low price of milk in the market		
	Frequency	Percent
Yes	10	32.3%
No	21	67.7%
Total	31	100.0%
Raw milk price fluctuation		
	Frequency	Percent
Yes	5	16.1%
No	26	83.9%
Total	31	100.0%
The temperature needed to preserve raw milk in the farm		

	Frequency	Percent
Yes	6	19.4%
No	25	80.6%
Total	31	100.0%
High prices of livestock feed (concentrated feed)		
	Frequency	Percent
Yes	15	48.4%
No	16	51.6%
Total	31	100.0%
High cost of fresh milk preservation methods		
	Frequency	Percent
Yes	5	16.1%
No	26	83.9%
Total	31	100.0%
High cost of fresh milk preservation methods		
	Frequency	Percent
Yes	5	16.1%
No	26	83.9%
Total	31	100.0%
Diseases affecting animals		
	Frequency	Percent
Yes	19	61.3%
No	12	38.7%
Total	31	100.0%
Other		
	Frequency	Percent
Yes	2	6.5%
No	29	93.5%
Total	31	100.0%

The main constraints facing production in dairy farms are:

1. High cost of concentrated feed.
2. Diseases affecting animals.
3. Agricultural labor shortage.
4. High prices of livestock feed (concentrated feed).

The stage after sending raw milk to the factory (from reception to the production of dairy products)

4.2 Research Questions Results

What is the level of quality Management that is applied in O2O E-Business for dairy industry in Palestine? And to arrive at this we should answer the following sub-questions:

4.2.1 Results Related to First Sub-question

- **How many tests are being run on unpasteurized milk? What are they?**

To answer this question:

Firstly: Do the factories test the milk before and after production?

Table (4.10): Tests before and after production

Raw milk is tested before production		
	Frequency	Percent
Yes	31	100.0%
Safety is re-tested after production		
	Frequency	Percent
Yes	31	100.0%

So, all factories test the milk before and after production which is a good sign.

Secondly: what are the tests used?

Table (4.11): Types of Tests

Basic Safety Tests for Milk (Texture, Color and Odor)		
	Frequency	Percent
Yes	31	100.0%
No	0	0.0%
Total	31	100.0%
Bacterial count test		
	Frequency	Percent

Yes	29	93.5%
No	2	6.5%
Total	31	100.0%
PH test		
	Frequency	Percent
Yes	26	83.9%
No	5	16.1%
Total	31	100.0%
Milk fat test		
	Frequency	Percent
Yes	29	93.5%
No	2	6.5%
Total	31	100.0%
Other tests		
	Frequency	Percent
Yes	14	45.2%
No	17	54.8%
Total	31	100.0%

The tests are done for milk in factories in sequence:

1. Basic Safety Tests for Milk (Texture, Color and Odor).
2. Bacterial count test.
3. Milk fat test.
4. PH test.

4.2.2 Results Related to Second Sub-question

- **How much is the average amount of milk being produced?**

To answer this:

The daily rate of milk production in the factory is:

Table (4.12): The daily rate of milk production in the factory in liters

	Frequency	Percent
10000	21	67.7%
15000	1	3.2%
17000	1	3.2%

20000	1	3.2%
30000	7	22.6%
Total	31	100.0%

As shown in the previous table, **67.7%** of the employees said that the daily production is **10000** liters.

Table (4.13): Statistics for the daily rate of milk production in the factory in liters

Mean	15225.81
Median	10000.00
Std. Deviation	8421.044
Variance	70913978.495
Minimum	10000
Maximum	30000

4.2.3 Results Related to Third Sub-question

- **How are dairy product quality inspections being conducted along the way?**

To answer this:

At First: Average time between milking and entering the manufacturing process.

Table (4.14): average time period between milking and the milk entering the manufacturing process

Number of hours	Frequency	Percent
1	2	6.5%
3	7	22.6%
4	1	3.2%
8	3	9.7%
24	17	54.8%
48	1	3.2%
Total	31	100.0%

As shown in the previous table 54.8% said that it took 24 hours (1 day) between milking and the milk entering the manufacturing process.

Table (4.15): Statistics for the average time period between milking and the milk entering the manufacturing process

Mean	16.35
Median	24.00
Std. Deviation	11.658
Variance	135.903
Minimum	1
Maximum	48

Second: The effect of this period.

Table (4.16): The effect of the time period between milking and production

What is the effect of this period on the shelf life of milk?		
	Frequency	Percent
Low	15	48.4%
No effect	14	45.2%
I don't know	2	6.5%
Total	31	100.0%
What is the effect of this period on the quality of milk and its products?		
	Frequency	Percent
Low	15	48.4%
No effect	14	45.2%
I don't know	2	6.5%
Total	31	100.0%

The effect of the period on milk quality and dairy products is low because the tanks and delivery trucks are adequately equipped.

Third: Factory temperature

Table (4.17): Statistics for the Factory temperature in C

Mean	5.58
Median	5.00
Std. Deviation	1.996

Variance	3.985
Minimum	2
Maximum	10

As shown in the previous table the mean temperature (the average temperature) is **5.58** º C , which is very low and suitable to maintain the quality of the products as known that the temperature must be (4 to 10)º C .

Fourth: Maintenance frequency in the factory

Table (4.18): Maintenance frequency

Equipment is maintained and tested		
	Frequency	Percent
Daily	12	38.7%
Weekly	7	22.6%
Monthly	7	22.6%
Yearly	5	16.1%
Total	31	100.0%
The factory is cleaned and disinfected		
	Frequency	Percent
Daily	31	100.0%
Weekly	0	0.0%
Monthly	0	0.0%
Yearly	0	0.0%
Total	31	100.0%
Pasteurization equipment is maintained		
	Frequency	Percent
Daily	4	12.9%
Weekly	14	45.2%
Monthly	13	41.9%
Yearly	0	0.0%
Total	31	100.0%
The condition of the refrigeration equipment is tested		
	Frequency	Percent
Daily	20	64.5%
Weekly	10	32.3%
Monthly	1	3.2%

Yearly	0	0.0%
Total	31	100.0%
Packing equipment is checked		
	Frequency	Percent
Daily	24	77.4%
Weekly	5	16.1%
Monthly	2	6.5%
Yearly	0	0.0%
Total	31	100.0%
The quality of containers and milk products is checked		
	Frequency	Percent
Daily	23	74.2%
Weekly	6	19.4%
Monthly	2	6.5%
Yearly	0	0.0%
Total	31	100.0%
Storage conditions are checked		
	Frequency	Percent
Daily	27	87.1%
Weekly	0	0.0%
Monthly	4	12.9%
Yearly	0	0.0%
Total	31	100.0%

The factories have a maintenance follow up with the highest percentage for:

1. Equipment is maintained and tested daily
2. The factory is cleaned and disinfected daily
3. Pasteurization equipment is maintained weekly
4. The condition of the refrigeration equipment is tested daily
5. Packing equipment is checked daily
6. The quality of containers and milk products is checked daily
7. Storage conditions are checked daily

Fifth: The quality system

Table (4.19): Factory quality system

Does the factory implement a quality system?		
	Frequency	Percent
Yes	31	100.0%
If yes, what is your system?		
	Frequency	Percent
ISO9001	26	83.9%
I don't know	5	16.1%
Total	31	100.0%

The quality system used in the factories is ISO9001, as shown in the previous table.

Sixth: The delivery

Table (4.20): The delivery of dairy products

Longest product delivery time in hours		
	Frequency	Percent
Less than 4	5	16.1%
4-6	13	41.9%
More than 6	13	41.9%
Total	31	100.0%
Delivery trucks equipped with a cooling system		
	Frequency	Percent
Yes	31	100.0%
Delivery trucks have a temperature monitoring system		
	Frequency	Percent
Yes	31	100.0%
Quality of refrigeration in delivery trucks		
	Frequency	Percent
High	31	100.0%
Unexpected delivery problems have already occurred		
	Frequency	Percent
Truck breakdown	4	12.9%
Road closures	4	12.9%

Nothing	23	74.2%
Total	31	100.0%
Suggested solutions		
	Frequency	Percent
Regular maintenance of trucks	4	12.9%
not specified	4	12.9%
nothing	23	74.2%
Total	31	100.0%

Delivery trucks are equipped with a cooling system, a temperature monitoring system and high quality of refrigeration to suit the longest delivery time which could reach more than 6 hours.

4.2.4 Results Related to Forth Sub-question

- **What factors have the greatest impact on the level of quality in each phase of production? What should be taken into account while evaluating the quality at each stage?**

To answer this:

1. Proposed solution to different stages of milk production.

Table (4.21): The stage of preparing the products:

	Agree (already used)	Agree (will use)	Neutral	Disagree	Approval degree
Offer nutrient-rich food to cows	93.5%	3.2%	3.2%	0.0%	High
Ensure that the cow's feed contains crops and bran	96.8%	0.0%	3.2%	0.0%	High

The use of experts and veterinarians to improve the nutrition of cows	96.8%	3.2%	0.0%	0.0%	High
Maintain cleanliness of feed storage facilities	100.0%	0.0%	0.0%	0.0%	High
Handbook made as a guide for dairy farmers	41.9%	51.6%	3.2%	3.2%	High
Dairy work with small dairy farms	45.2%	16.1%	38.7%	0.0%	Medium
Using an automated milking system	100.0%	0.0%	0.0%	0.0%	High
Take care to monitor the cowsheds and make plans to manage the risks they face	96.8%	0.0%	3.2%	0.0%	High
Improving the quality of life of cows on farms	74.2%	16.1%	9.7%	0.0%	High
Sterilization and cleaning of cowsheds	100.0%	0.0%	0.0%	0.0%	High
Ensure the implementation of animal health programs	90.3%	3.2%	6.5%	0.0%	High
Cow udder sterilization system	93.5%	3.2%	0.0%	3.2%	High

This stage focused on obtaining raw milk of high quality by taking care of the cows in the farm, and this was shown through the lines and sentences in the previous table, and it was found that the factories are interested in this, as it appears from the high approval rate.

Table (4.22): Production and distribution processing:

	Agree (already used)	Agree (will use)	Neutral	Disagree	Approval degree

Using raw materials (raw milk) from approved suppliers (milk farms)	93.5%	0.0%	6.5%	0.0%	High
Take care to monitor and inspect raw materials (raw milk) to ensure quality	96.8%	0.0%	3.2%	0.0%	High
Ensure that the product meets the standards set by the Palestinian Standards Institution	96.8%	0.0%	3.2%	0.0%	High
Increase the frequency of sample inspection	58.1%	9.7%	32.3%	0.0%	High
Transparency of information exchanged between all parties in the supply chain	74.2%	3.2%	22.6%	0.0%	High
Dairy products meet national and international quality standards	90.3%	0.0%	9.7%	0.0%	High
Automatically control the cooling system	83.9%	6.5%	9.7%	0.0%	High
Availability of backup cooling system	77.4%	16.1%	6.5%	0.0%	High

This stage centered on inspecting the raw milk before manufacturing, then beginning to produce it for various goods and ensuring that these products met the criteria and standards, as demonstrated by the lines and words in the preceding table. The responses reveal a high level of approval.

Table (4.23): Sorting process:

	Agree (already used)	Agree (will use)	Neutral	Disagree	Approval degree

Ensure that sorting equipment is in good condition regularly	90.3%	3.2%	6.5%	0.0%	High
Use new technology equipment to ensure that the packaging is leak-proof	87.1%	9.7%	3.2%	0.0%	High
Using different materials other than plastic for packaging dairy products	67.7%	22.6%	9.7%	0.0%	High
A quality assurance system is used	90.3%	6.5%	3.2%	0.0%	High

This stage concentrated on sorting the items and packing them properly, as seen by the lines and sentences in the previous table, and it was discovered that the factories are interested in this, as evidenced by the high acceptance rate.

Table (4.24): Delivery links:

	Agree (already used)	Agree (will use)	Neutral	Disagree	Approval degree
Develop market-appropriate delivery plans	90.3%	0.0%	9.7%	0.0%	High
Quality control of products leaving the factory	93.5%	3.2%	3.2%	0.0%	High
Develop a product tracking system	87.1%	9.7%	3.2%	0.0%	High
Maintain proper temperature during delivery process	96.8%	0.0%	3.2%	0.0%	High
Providing the necessary equipment and resources to face problems that may arise during transportation and delivery	67.7%	25.8%	6.5%	0.0%	High

This stage concentrated on developing distribution arrangements and ensuring the quality of items leaving the facility. This was demonstrated by the lines and words in the preceding table, and it was discovered that the factories are interested in this, as evidenced by the high approval rate.

2. The possibility of implementing the idea of (O2O e-business)

Table (4.25): Recognized Effectiveness of Online Product Reviews

	Agree	Neutral	Disagree	Approval degree
We have a website where we display our products.	93.5%	3.2%	3.2%	High
We have knowledge of O2O e-business system for online ordering and product delivery.	25.8%	25.8%	48.4%	Low
Online reviews are reliable and dependable on what people think of our products.	67.7%	29.0%	3.2%	High
Online reviews provide accurate information on whether people can order our products online.	38.7%	61.3%	0.0%	Medium
We can send our products abroad based on internet requests.	51.6%	45.2%	3.2%	Medium

The focus here was on determining if the factories were safe. Every factory has a website where they can show their products, and the inquiry is about their understanding of the O2O e-business system for purchasing online, delivering things, and using them. The factories are interested in the websites, but their expertise in O2O is limited.

Table (4.26): The perceived effectiveness of online product descriptions:

	Agree	Neutral	Disagree	Approval degree
The photos and videos available online represent the products in the stores.	67.7%	32.3%	0.0%	High
Written descriptions posted online about our products are reliable and accurate.	87.1%	12.9%	0.0%	High
The texts, videos and images of our products are constantly updated online.	77.4%	22.6%	0.0%	High
Online texts, videos and images help to identify information about our products.	83.9%	16.1%	0.0%	High

In this section, we discussed websites by determining whether the images and videos available on the Internet accurately represent the products in stores, whether written descriptions posted on the internet about the products are reliable and accurate, and whether the manufacturers' interest is indicated by high approval.

Table (4.27): Trust in merchants:

	Agree	Neutral	Disagree	Approval degree
People consider online shopping to be better and more trustworthy.	71.0%	22.6%	6.5%	High
People consider the offline merchant to be able to offer their products better.	25.8%	35.5%	38.7%	Low
People consider that the offline merchant better fulfils his promises and obligations.	35.5%	22.6%	41.9%	Medium
People consider that an offline merchant has their needs in mind because he knows his customers better.	32.3%	29.0%	38.7%	Low

In this section, we discussed the state of trust in online and offline merchants and the belief among factory employees that people are becoming more trusting of online shopping.

Table (4.28): Purchasing Intent:

	Agree	Neutral	Disagree	Approval degree
It is important that the website when viewed is attractive and encourages the purchase of a product.	90.3%	9.7%	0.0%	High
It is important to make people feel that it is beneficial to buy our products online.	48.4%	51.6%	0.0%	Medium
The experience of buying from the site and products should be unique to motivate people to buy again	90.3%	9.7%	0.0%	High
People should be motivated when buying so that they will recommend our site to others.	77.4%	22.6%	0.0%	High

In this section, the intent to buy is discussed. There was a consensus on the importance of an attractive website that encourages product purchases.

3. Fuzzy Bayesian Network Model to study the possibility of quality management in the dairy industry in Palestine.

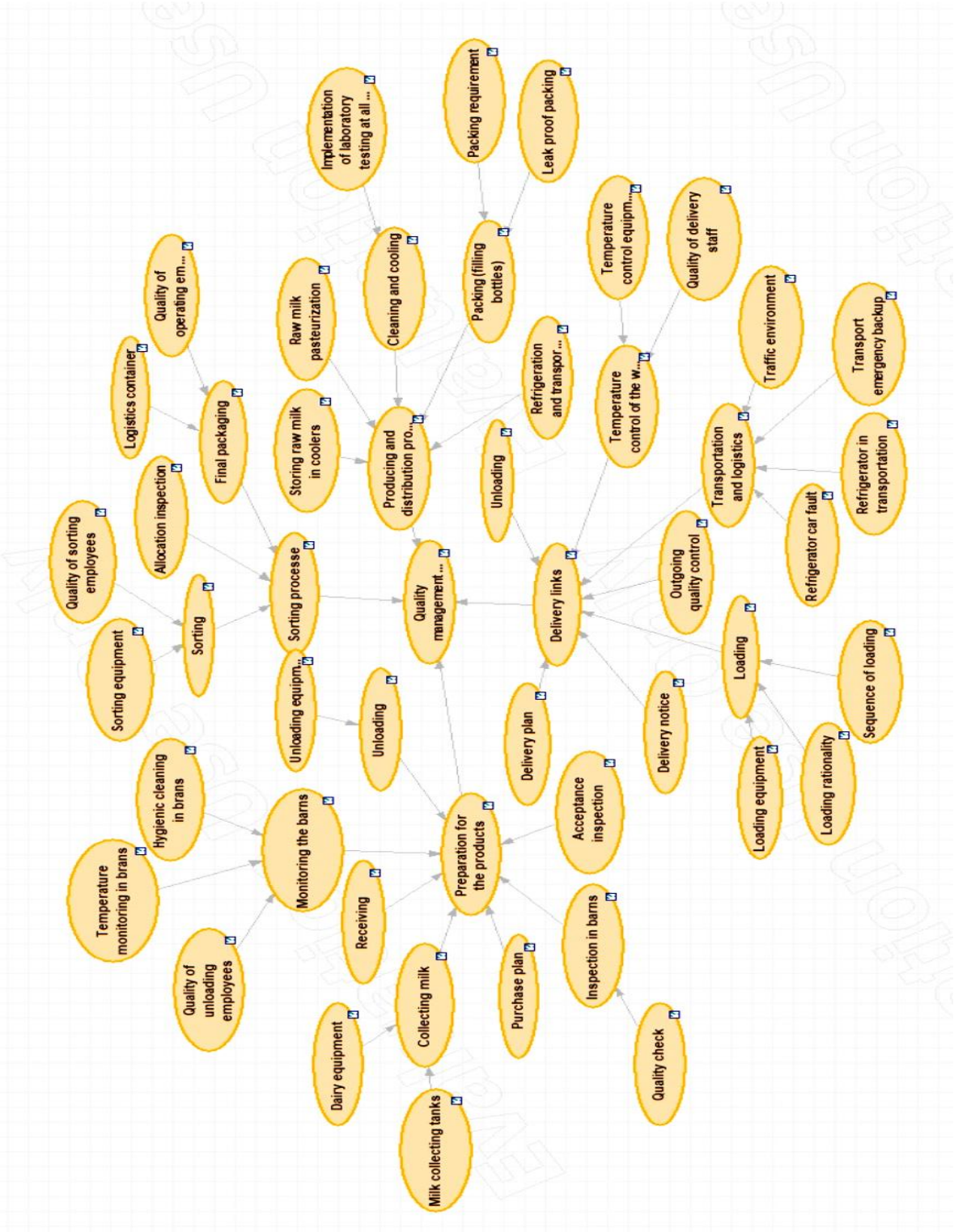


Fig. (4.1): Bayesian network of dairy product quality[1]

[1] GeNIe Version 3.0.6518.2 (64-bit).< https://www.bayesfusion.com/>. [Accessed 10 June 2022].

The above network is done according the following table (Table (4.29)),(A) is the biggest topic, from (A1 to A4) are the main stages, from (B1 to B22) are the substages and from (C1 to C23) these are the things related to the substages. So, as we can see, the stage from (C1 to C23) refer directly to the stage (B1 to B22), which also go back to the stage (A1 to A4), and in the end, all return to the main topic (A).

Table (4.29): Arrangement of stages in the Bayesian Network (based on Zhang et al, 2020)

Number	Node
A	Quality management of dairy products
A1	Preparation for the products
A2	Producing and distribution processing
A3	Sorting process
A4	Delivery links
B1	Acceptance inspection
B2	Inspection in barns
B3	Purchase plan
B4	Collecting milk
B5	Unloading
B6	Receiving
B7	Monitoring the barns
B8	Storing raw milk in coolers
B9	Raw milk pasteurization
B10	Cleaning and cooling
B11	Packing (filling bottles)
B12	Refrigeration and transportation
B13	Sorting
B14	Allocation inspection
B15	Final packaging
B16	Delivery plan
B17	Delivery notice
B18	Outgoing quality control
B19	Loading
B20	Transportation and logistics
B21	Temperature control of the whole-process
B22	Unloading
C1	Dairy equipment
C2	Milk collecting tanks
C3	Unloading equipment
C4	Quality of unloading employees
C5	Quality check
C6	Temperature monitoring in brans

C7	Hygienic cleaning in brans
C8	Refrigerator in transportation
C9	Transport emergency backup
C10	Implementation of laboratory testing at all stages of production
C11	Packing requirement
C12	Leak proof packing
C13	Sorting equipment
C14	Quality of sorting employees
C15	Logistics container
C16	Quality of operating employees
C17	Loading equipment
C18	Loading rationality
C19	Sequence of loading
C20	Refrigerator car fault
C21	Traffic environment
C22	Temperature control equipment
C23	Quality of delivery staff

Table (4.30): The probability of the event and the equivalent triangular fuzzy number

The probability	Triangular fuzzy number	Expression declaration
From 0% to 33.333%	(0, 0.1, 0.3)	Low
From more than 33.333% to 66.666%	(0.3, 0.5, 0.7)	Medium
From more than 66.666% to 100%	(0.7, 0.9, 1)	High

This table explain the idea of fuzzy, the probability division and the expression declaration. In the following tables, the probability ratios for each sentence are shown.

Table (4.31): Main stages related to dairy quality management:

	Agree	Neutral	Disagree	Approval degree
Quality management begins with the preparation stage of the products	83.9%	6.5%	9.7%	High

The second stage is related to the processing of raw milk, production of products and then distribution.	93.5%	6.5%	0.0%	High
The third stage is the sorting process for different products.	96.8%	3.2%	0.0%	High
The last stage is related to the delivery links	90.3%	9.7%	0.0%	High
I think there are other stages	83.9%	6.5%	9.7%	High

Factors affecting quality at each stage

Table (4.32): The first stage:

	Agree	Neutral	Disagree	Approval degree
Accept inspection	96.8%	3.2%	0.0%	High
Barn inspection	93.5%	6.5%	0.0%	High
Purchase plan	80.6%	19.4%	0.0%	High
Collecting milk	96.8%	3.2%	0.0%	High
Unloading	93.5%	6.5%	0.0%	High
Receiving	96.8%	3.2%	0.0%	High
Barn’s monitoring	96.8%	3.2%	0.0%	High

Table (4.33): The second stage

	Agree	Neutral	Disagree	Approval degree
Storing raw milk in coolers	93.5%	3.2%	3.2%	High
Raw milk pasteurization	93.5%	6.5%	0.0%	High
Cleaning and cooling	96.8%	3.2%	0.0%	High
Packing (bottle filling)	77.4%	22.6%	0.0%	High
Refrigeration and transportation	96.8%	3.2%	0.0%	High

Table (4.34): The third stage

	Agree	Neutral	Disagree	Approval degree
Sorting	96.8%	3.2%	0.0%	High
Allocation inspection (ensure that each product is in the allotted place)	93.5%	6.5%	0.0%	High
Final packaging	96.8%	3.2%	0.0%	High

Table (4.35): The fourth stage

	Agree	Neutral	Disagree	Approval degree
Delivery plan	96.8%	3.2%	0.0%	High
Delivery notice	96.8%	3.2%	0.0%	High
Outgoing quality control	96.8%	3.2%	0.0%	High
Loading	93.5%	6.5%	0.0%	High
Transportation and logistics	93.5%	6.5%	0.0%	High
Temperature control of the whole process	96.8%	3.2%	0.0%	High
Unloading	93.5%	6.5%	0.0%	High

Table (4.36): Things to take care of at each stage:

	Agree	Neutral	Disagree	Approval degree
Dairy equipment	96.8%	3.2%	0.0%	High
Milk collecting tanks	96.8%	3.2%	0.0%	High
Unloading equipment	93.5%	3.2%	3.2%	High
How much the unloading employees care about quality	96.8%	3.2%	0.0%	High
Quality Check	96.8%	3.2%	0.0%	High
Temperature monitoring in barns	83.9%	16.1%	0.0%	High
Hygienic cleaning in the barns	87.1%	12.9%	0.0%	High
Refrigerator in transportation	96.8%	3.2%	0.0%	High

Transport emergency backup	90.3%	9.7%	0.0%	High
Implementation of laboratory testing at all stages of production	83.9%	16.1%	0.0%	High
Packing requirements	90.3%	9.7%	0.0%	High
Leak-proof packing	96.8%	3.2%	0.0%	High
sorting equipment	93.5%	6.5%	0.0%	High
The extent to which the sorting employees care about quality	90.3%	9.7%	0.0%	High
Logistics container	93.5%	6.5%	0.0%	High
How much operating employees care about quality	96.8%	3.2%	0.0%	High
Loading equipment	90.3%	9.7%	0.0%	High
Rationality of loading methods	87.1%	12.9%	0.0%	High
Sequence of loading	83.9%	12.9%	3.2%	High
Car refrigerator malfunction	77.4%	19.4%	3.2%	High
Traffic environment	90.3%	6.5%	3.2%	High
Temperature control equipment	90.3%	9.7%	0.0%	High
How much the delivery staff care about quality	93.5%	6.5%	0.0%	High

In the following figure, the probability ratios are shown on the Bayesian network.

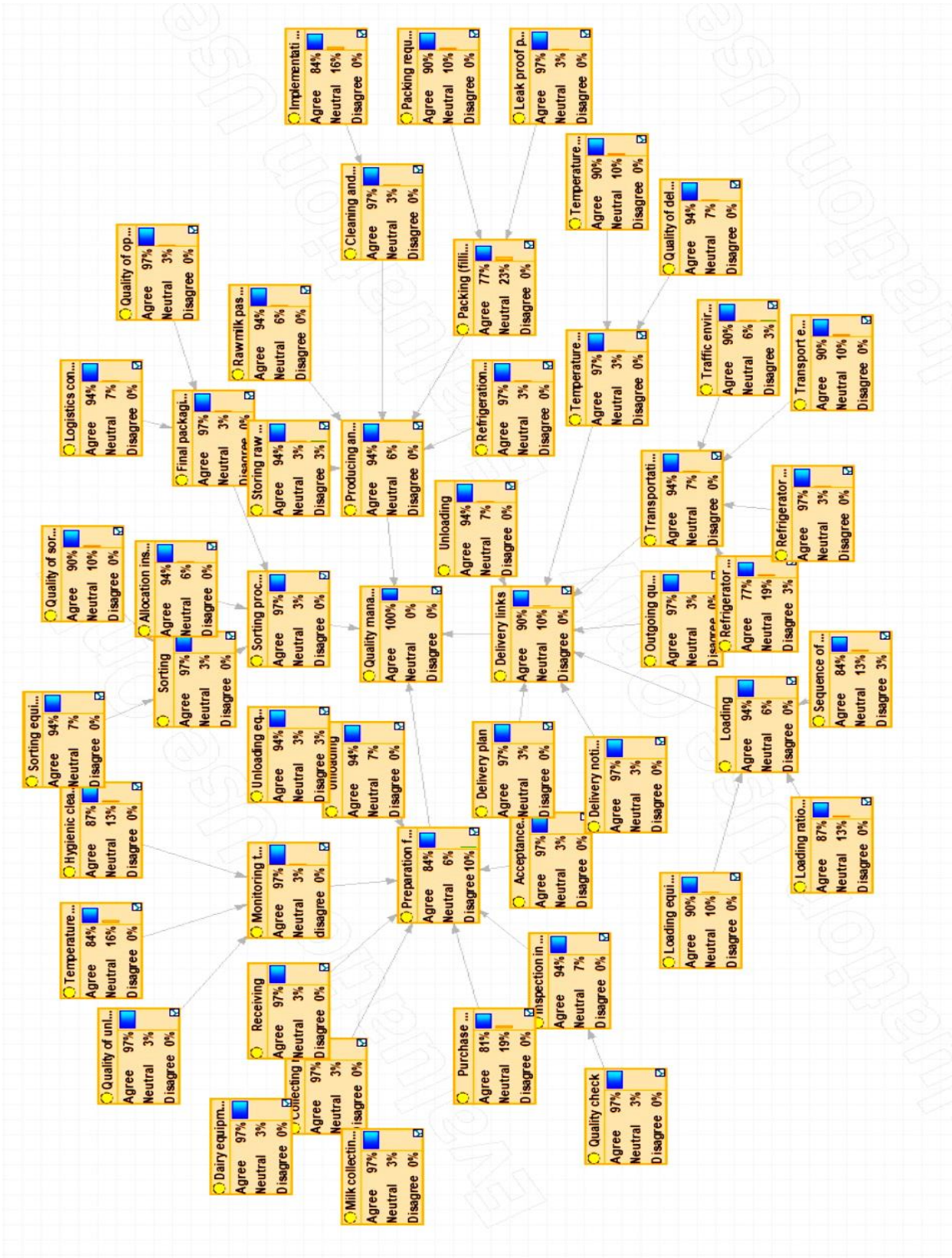


Fig. (4.2): The probability model[1]

[1] GeNIe Version 3.0.6518.2 (64-bit).< https://www.bayesfusion.com/>. [Accessed 10 June 2022].

4.3 Discussion

In the present study, we examined a Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for dairy industries in Palestine through the following dimensions:

The stage before sending the raw milk to the factory (At dairy cattle farm)

The mean value for the number of dairy cows is (870.97) which is roughly 871 cows whereas it varies between 200 and 2000 cows, for the number of times that the cows are milked daily the mean is (2.58) because 58.8% said they milked three times and 41.9% said they milked cows twice and for Milk quantity in liters the mean value is (25306.45) as it varies between 10,000 and 50,000 liters. This variation between the minimum and maximum values in the number of cows and the milk quantity could mean that not all of the answers accurate.

For the dairy cattle farm and the safety measures. All factories use automated milking system, also all of the factories clean the udder of cows with iodine before milking and 61.3% of them said that they combine milk from different milking times together before send it to use in the production.

About the most important plans to increase the production of raw milk the answers is as the following: improvement of cow breeds is 77.4%, increasing the number of dairy cows is 74.2% and get more outside advice from the experts is 64.5% all of these is

very important to increase raw milk production in farms also controlling cattle diseases could be added to this.

For the constraints that face production in dairy farm: high cost of concentrated feed is 64.5%, diseases affecting animals is 61.3%, agricultural labor shortage is 58.1% and high prices of livestock feed (concentrated feed) also could be added.

The stage after sending raw milk to the factory (from reception to the production of dairy products)

The raw milk is always tested before production and then test them again after production to ensure the quality and safety of milk. The main tests done for milk in factories are: Basic Safety Tests for Milk (Texture, Color and Odor) is 100%, Bacterial count test and Milk fat test have the same percentage which is 93.5% and PH test is 83.9% these tests are various and important types: the morphological and sensory milk tests like Basic Safety Tests for Milk, the natural and chemical milk tests like Milk fat test and PH test.

The mean value for the daily rate of milk production in the factory in liters is (15225.81), for the average time period between milking and the milk entering the manufacturing process in hours is (16.35) hours as it varies between 1 hour and 24 hours this period doesn't affect the quality of milk because the tanks and trucks that they store and deliver milk in them are suitable to keep the quality of the milk.

For the Factory temperature its 5.58º C this is between (4 and 10) º C which is the average temperature of dairy factories.

Maintenance frequency in the factories almost daily for example the factory is cleaned and disinfected daily. All factories implement a quality system and the quality system that they use is ISO9001.

The longest delivery time of dairy products could be more than 6 hours and all the equipments in delivery trucks are suitable for the delivery time.

The stage of preparing the products focused on gaining a high-quality raw milk. The stage of production and distribution processing which focused on inspecting the raw milk before production. For the sorting process focused on sorting and packing products and for the delivery links it focused on developing delivery and distribution arrangements that ensure the quality of products that go from the factory to markets and consumers all of this have a high degree approval.

For the following statements express the possibility of implementing the idea of (O2O e-business):

Recognized effectiveness of online product reviews has a different degree of approval for example every factory has a website to show the products but they don't have a knowledge about O2O e-business. For the perceived effectiveness of online product descriptions, it has a high degree of approval as it discussed whether the images and videos on the factory website are accurate and represent the actual products truly. For the trust in merchants, it has a different degree of approval and for the Purchasing Intent it has a high approval.

A Fuzzy Bayesian Network Model to study the possibility of quality management in the dairy industry in Palestine has a high degree of approval. The researcher built this

model according to the pervious studies and the researcher researches using GeNIe software to build the network, whereas the main topic (quality management of dairy products) was placed in the center, followed by the four main stages that branch off the main topic. And every stage of these four main stages has substages then the substages have many related things that back to them.

Chapter V

Conclusions & Recommendations

5.1 Conclusions and Recommendations

Chapter V

5.1 Conclusions and Recommendations

From the results obtained of this research we conclude the following:

First hypothesis:**" All safety and prevention measures would be followed when collecting milk and the farms would be strive primarily to confront diseases that affect cows"**

We accept the hypothesis based on the results of all sentences in table (4.7) about the safety and according to the tables (4.8) and (4.9) sequentially 45.2% believe that to increase raw milk production in farms they need to focus on confronting and controlling cattle diseases and 61.3% believe that diseases affecting animals (cows) is one of the main constraints that face the dairy farms.

Recommendations:

- Experts should be employed to come up with novel and more practical methods to handle the issues they confront in the farms as soon as they are recognized once the primary reasons and problems have been identified.
- The use of specialists to simulate certain unforeseen issues in order to create advance preparations and attempt to minimize any negative repercussions should they occur in the future.
- To control the diseases affecting animals, more research is needed to improve the efficacy of existing preventive and therapeutic treatments, as well as to develop new diagnostics and vaccines.

- To get around the high cost of concentrated feed There are several regional and national interventions related to warehousing infrastructure, such as preparing for the possibility of implementing a project. Stocking feed inputs while also working to improve local breeds for a variety of wealth animals.

Second hypothesis:**" Daily maintenance and testing of raw milk are done, furthermore at least two tests would be conducted"**

We accept the hypothesis based on the results of the most of the sentences in table (4.18) about the maintenance frequency and according to table (4.11) 93.5% said that three tests are performed (Basic safety tests, Bacterial count test and Milk fat test).

Recommendations:

- Take precautions to ensure routine maintenance and to avoid neglecting adequate and appropriate milk tests.
- Bacteriological tests on milk or milk products are not precise measurements. Because milk's bacteriological content can vary significantly from day to day, testing should be done as frequently as possible. It should be reiterated that the hygienic quality of milk is determined by a number of factors. As a result, many tests must be performed with great care.

Third hypothesis:**" To achieve the highest quality milk, all practices accessible in farms and facilities would be implemented"**

We accept the hypothesis based on the results of the tables (4.21), (4.22), (4.23) and (4.24) because the answers of the sentences on these tables shows a high approval degree.

Recommendations:

- Ensure that the suggested solutions and ideas are implemented in the future at all stages along the supply chain, starting with the stage of cow care to acquire higher-quality raw milk and ending with the delivery of dairy products to the customer.
- The primary determinant of the quality of milk products is the quality of raw milk. Only high-quality raw milk can be used to produce high-quality milk products. Milk hygiene is critical in producing milk and milk products that are safe and appropriate for their intended uses. Good hygiene practices should be used throughout the dairy chain to achieve this quality.

Forth hypothesis:**" Online and O2O technologies available as of now would be seen in a positive light by the customers for dairy product sales and purchases"**

We reject the hypothesis based on the results of the tables (4.25), (4.26), (4.27) and (4.28) because the answers of the sentences on these tables shows a different degree of approval. For example, in table (4.25) just 25.8% agree that they know about O2O e-business system for online ordering and product delivery which is a low approval degree.

Recommendations:

- Improve consumers' online shopping experiences by optimizing business websites, providing clips of their products, and working to make it possible to place orders both inside and outside of the country, as an Implementation of O2O to Dairy Products.
- Develop the website that showcase products and, if possible, include the ability to purchase directly from the website.
- Improve the knowledge of O2O e-business system for online ordering and product delivery.

Fifth hypothesis:**" The proposed model combination would be approved for the fuzzy Bayesian network"**

We accept the hypothesis based on the results of the tables (4.31), (4.32), (4.33), (4.34), (4.35) and (4.36) because the answers of the sentences on these tables shows a high approval degree.

Recommendations:

- Developing the Fuzzy Bayesian network model and working with it in the factories.

A qualification criterion for the O2O model's flow regulation of dairy products was put out in this study. By thoroughly evaluating the indicator information, data leakage is prevented for customers and downstream firms. The provision of products and the administration of supervision are made possible by the integration of e-business platforms in this process.

Future research directions and recommendations:

1. The analysis and assessment of logistics supply chain is largely about delivery and enhancement may also be studied and assessed from the supply chain itself.
2. To perform long-term research for small and large dairy factories and other food factories.
3. The study was limited to Palestine, so the findings must be validated in a different country with similar demographics.

The limitations that the study faced:

Most of the difficulties that is faced throughout making this study revolve around the factories responses and feedback. mainly, over two months period of communication and many visits in attempt to get an interview with the employees to fill the questioner, only three factories complied and only 31 samples were sent back which were filled online

References:(articles)

Nguyen, L. (2013). Overview of Bayesian Network. Sci. J. Math. Stat, 2013.

Iqbal, A., Endo, K., Fukuda, O., Arai, K., Okumura, H., & Yamashita, K. (2016). Japanese dairy cattle productivity analysis using Bayesian network model (BNM). *International Journal of Advanced Computer Science and Applications, 7(11).*

Akhmetova, S., & Suleimenova, M. (2018). Quality management system for improvement of quality and efficiency of food production: case of dairy products enterprise. *Entrepreneurship and Sustainability Issues, 6(1),* 289-310.

Ali, K. A. M., & Talib, H. H. A. (2010). Total quality management approach for Malaysian food industry: conceptual framework. *No. Paper ID, 892*.

Bartkiene, E., Steibliene, V., Adomaitiene, V., Juodeikiene, G., Cernauskas, D., Lele, V., ... & Guiné, R. P. (2019). Factors affecting consumer food preferences: food taste and depression-based evoked emotional expressions with the use of face reading technology. *BioMed Research International, 2019.*

Baudrit, C., Sicard, M., Wuillemin, P. H., & Perrot, N. (2009). Dynamic bayesian networks for modelling food processing: Application to the cheese ripening process. *In 8th World Congress of Chemichal Engineering (Vol. 9).*

Burney, S.M.Aqil. (2020). Risk Analysis and Management using Fuzzy Logic for Software Projects.

Cavetti, D. (2018). O2O Services in China. Master's Degree program in Languages, Economics and Institutions of Asia and North Africa "ex D.M. 270/2004".

Siong, T. C., Ismail, B., Siraj, S. F., & Mohammed, M. F. (2011). Fuzzy logic controller for BLDC permanent magnet motor drives. *International Journal of Electrical & Computer Sciences, 11(2),* 13-18.

Chentao, S., & Yongle, W. (2014). Online to Offline Business Model Comparative Study of Chinese O2O Companies. *Sweden: Halmstad University,* 1-87.

Cristina, S. A., Elena, C., & Cristina, Z. (2017). Quality Management in E-Commerce. *Ovidius University Annals, Economic Sciences Series, 17(1),* 388-391.

Dubois, D., & Prade, H. (2016). The emergence of fuzzy sets: A historical perspective. In *Fuzzy logic in its 50th year* (pp. 3-19). Springer, Cham.

Hanf, J.H. & Pieniądz, A. (2007). Quality Management in Supply Chain Networks - The Case of Poland. *The International Food and Agribusiness Management Review, 10*, 102-128.

He, Z., Han, G., Cheng, T. C. E., Fan, B., & Dong, J. (2018). Evolutionary food quality and location strategies for restaurants in competitive online-to-offline food ordering and delivery markets: An agent-based approach. *International Journal of Production Economics*. 215.

Jeong, Y. J., & Song, Y. k. (2016). A Study on the Factors Affecting the Intention to Use O2O Services. *Journal of Information Technology Services, 15(4),* 125–151.

Kang, D., & Kim, S. (2018). The Effects of O2O Service Factors on Sequel Service Adoption: O2O Service Quality Dimensions and Perceived Fit. 22nd Biennial Conference of the International Telecommunications Society (ITS): "Beyond the Boundaries: Challenges for Business, Policy and Society", Seoul, Korea, 24th-27th June, 2018, International Telecommunications Society (ITS), Calgary.

Kang, M. J., WU, Z., & Hwang, H. J. (2021). A Study on the Mediating Effect of Customer Orientation between O2O Service Quality and Customers' Perceived Service Satisfaction. *Journal of Distribution Science, 19(2),* 37-44.

Karakök, G. S. (2007). Quality concept for dairy profitability. *Hayvansal Üretim,* 48(2), 60-64.

Keskin, O. Y., & Gulsunoglu, Z. (2012). Quality Management Systems in Dairy Industry.

Khatoon, R., Chakraborty, D., Chandni, R.C., Sankar, A., & Raghu, A.V. (2017). Food Quality Management and Safety. *International Journal of Research - Granthaalayah, 5(4) RAST,* 116–121.

Köpke, U. (2005). Organic foods: do they have a role?. *Diet diversification and health promotion, 57,* 62-72.

Kotsanopoulos, K. V., & Arvanitoyannis, I. S. (2017). The Role of Auditing, Food Safety, and Food Quality Standards in the Food Industry: A review. *Comprehensive reviews in food science and food safety*, *16*(5), 760–775.

Lachapelle, E., Aliu, F., & Bina, L. (2015). ISO 9001:2015 Quality Management System – Requirements.

Pollino, C. A., & Henderson, C. (2010). Bayesian networks: A guide for their application in natural resource management and policy. *Landscape Logic, Technical Report, 14.*

Latini, M. (2019). Factors that influence the adoption of an online-to-offline strategy in retail.

Li, H. (2017). O2O-Based Agricultural Products Supply Chain Process Integration Optimization Based on Internet+. In *MATEC Web of Conferences* (Vol. 100, p. 02036). EDP Sciences.

Lie, Y., Atmojo, R. N. P., & Muljo, H. H. (2019). The effectiveness of O2O strategy on e-commerce transactions. *The Winners, 20(1),* 9-17.

Lima, M. D. & Nassar, S. M. (2019). Fuzzy Method for Online Learning of Bayesian Network Parameters. *Journal of Computer Science, 15(3),* 372-383.

Looney, C. G. & Dascalu, S. (2007). A Simple Fuzzy Neural Network. Conference: Proceedings of the ISCA 20th International Conference on Computer Applications in Industry and Engineering, CAINE 2007, November 7-9, 2007, San Francisco, California, USA.

Lucci, G. M., Nash, D., McDowell, R. W., & Condron, L. M. (2014). Bayesian network for point and diffuse source phosphorus transfer from dairy pastures in South Otago, New Zealand. *Journal of environmental quality, 43(4),* 1370-1380.

Luning, P. A., & Marcelis, W. J. (2007). A conceptual model of food quality management functions based on a techno-managerial approach. *Trends in food science & technology*, 18(3), 159-166.

Molina, E., Amigo, L., & Quirós, A. (2009). 11 Sensory Profiling of Market Milks. *Milk Processing and Quality Management*, 294.

Mrad, A. B., Maalej, M. A., Delcroix, V., Piechowiak, S., & Abid, M. (2011). Fuzzy evidence in Bayesian network. In *2011 International Conference of Soft Computing and Pattern Recognition (SoCPaR)* (pp. 486-491). IEEE.

Kim-Soon, N., Mostafa, S. A., Nurunnabi, M., Chin, L. H., Kumar, N. M., Ali, R. R., & Subramaniam, U. (2020). Quality management practices of food

manufacturers: a comparative study between small, medium and large companies in Malaysia. *Sustainability*, 12(18), 7725.

Nordenskjöld, J. (2012). Implementation of a quality management system in food production.

Nyokabi, S., Luning, P. A., de Boer, I. J., Korir, L., Muunda, E., Bebe, B. O., ... & Oosting, S. J. (2021). Milk quality and hygiene: Knowledge, attitudes and practices of smallholder dairy farmers in central Kenya. *Food Control*, 130, 108303.

Okpala, C. O. R., & Korzeniowska, M. (2021). Understanding the relevance of quality management in agro-food product industry: From ethical considerations to assuring food hygiene quality safety standards and its associated processes. *Food Reviews International*, 1-74.

Onisko, A. (2008). Medical diagnosis. Bayesian Networks: A Practical Guide to Applications. 73. 15-32.

Liboreiro Paiva, C. (2013). Quality Management: Important Aspects for the Food Industry, *Food Industry*.

Paiva, Y., Azevedo, P., Rodrigues, I., França, K., Farias, J., Alencar, M., Pereira, V., Da Silva, E., Machado, V., Lima, P., Feitosa, M., & Bezerra, F. (2019). Quality management tools in food industry. *International Journal of Development Research, 9(4),* 26897-26900.

Petrescu, D. C., Vermeir, I., & Petrescu-Mag, R. M. (2020). Consumer understanding of food quality, healthiness, and environmental impact: A cross-national perspective. *International journal of environmental research and public health, 17(1),* 169.

Ram, J., & Sun, S. (2020). Business benefits of online-to-offline ecommerce: A theory driven perspective. *Journal of Innovation Economics Management, 33(3),* 135-162.

Ren, J., Jenkinson, I., Wang, J., Xu, D. L., & Yang, J. B. (2009). An offshore risk analysis method using fuzzy Bayesian network. *Journal of Offshore Mechanics and Arctic Engineering, 131(4).*

Rosak-Szyrocka, J., & Abbase, A. A. (2020). Quality management and safety of food in HACCP system aspect. *Production Engineering Archives*, 26.

Ruggeri, F., Faltin, F., & Kenett, R. (2007). Bayesian networks. *Encyclopedia of Statistics in Quality & Reliability, 1(1),* 4.

Ryhajlo, N., Sturlaugson, L., & Sheppard, J. W. (2013). Diagnostic Bayesian networks with fuzzy evidence. In *2013 IEEE AUTOTESTCON* (pp. 1-8). IEEE.

Sarkar, B., Dey, B. K., Sarkar, M., & AlArjani, A. (2021). A sustainable online-to-offline (O2O) retailing strategy for a supply chain management under controllable lead time and variable demand. *Sustainability*, 13(4), 1756.

Sarkar, B., Tayyab, M., & Choi, S. B. (2018). Product Channeling in an O2O supply chain management as power transmission in electric power distribution systems. *Mathematics*, 7(1), 4.

Sayler, A. (2009). 10 Hazard Analysis (Appraisal) Critical Control Point (HACCP) in Milk Processing–A Practical Overview. *Milk Processing and Quality Management*, 253.

Savino, M. M., & Sekhari, A. S. (2009). A quality management system based on fuzzy quality pointers in ISO 9000. *International journal of product development*, 8(4), 419-430.

Sevinc, V., Akkuş, Ö., Takma, Ç., & Güneri, Ö. İ. (2020). Bayesian network analysis for the factors affecting the 305-day milk productivity of holstein friesians. *Journal of Agricultural Sciences, 26(2),* 173-180.

Shang, K., & Hossen, Z. (2013). Applying fuzzy logic to risk assessment and decision-making. *Casualty Actuarial Society, Canadian Institute of Actuaries, Society of Actuaries,* 1-59.

Shapiro, A. F., & Koissi, M. C. (2015). Risk assessment applications of fuzzy logic. *Casualty Actuarial Society, Canadian Institute of Actuaries, Society of Actuaries: Ottawa, ON, Canada*, 390.

Talib, H. H. A., Ali, K. A. M., & Idris, F. (2013). Quality management framework for the SME's food processing industry in Malaysia. *International Food Research Journal*, 20(1), 147.

Technews (2008). Food Safety and Quality Management Systems. National Dairy Development Board For Efficient Dairy Plant Operation. No.77.

Terán-Bustamante, A., Martínez-Velasco, A., & Dávila-Aragón, G. (2021). Knowledge management for open innovation: Bayesian networks through machine learning. *Journal of Open Innovation: Technology, Market, and Complexity, 7(1),* 40.

Xu, T., & Zhang, J. (2015). A development strategy of O2O business in China. In *2015 International Conference on Computer Science and Intelligent Communication* (pp. 337-340). Atlantis Press.

Tsai, T. M., Wang, W. N., Lin, Y. T., & Choub, S. C. (2015). An O2O commerce service framework and its effectiveness analysis with application to proximity commerce. *Procedia Manufacturing, 3,* 3498-3505.

Van Der Spiegel, M., Luning, P. A., De Boer, W. J., Ziggers, G. W., & Jongen, W. M. F. (2006). Measuring effectiveness of food quality management in the bakery sector. *Total Quality Management & Business Excellence, 17(6)*, 691-708.

Velázquez-Ordoñez, V., Valladares-Carranza, B., Tenorio-Borroto, E., Talavera-Rojas, M., Varela-Guerrero, J. A., Acosta-Dibarrat, J., ... & Pareja, L. (2019). Microbial contamination in milk quality and health risk of the consumers of raw milk and dairy products. *Nutrition in Health and disease-our challenges Now and Forthcoming time.*

Vissers, M. M. M., & Driehuis, F. (2009). On-farm hygienic milk production. *Milk processing and quality management*, 1-22.

Wang, J., Zhang, Q., & Ji, W. (2014). Construction of monitoring model and algorithm design on passenger security during shipping based on improved Bayesian network. *The Scientific World Journal, 2014*.

Wang, O. (2020). Consumer adoption of online-to-offline food delivery services: A conceptual model. In *Advances in Digital Marketing and eCommerce* (pp. 99-105). Springer, Cham.

Wang, O., Somogyi, S., & Charlebois, S. (2020). Food choice in the e-commerce era: a comparison between business-to-consumer (B2C), online-to-offline (O2O) and new retail. *British Food Journal.*

Wiegerinck, W., Burgers, W., & Kappen, B. (2011). Bayesian Networks, Introduction and Practical Applications (final draft). *networks, 26(18)*, 7.

Yang, L., & Tang, R. (2019). Comparisons of sales modes for a fresh product supply chain with freshness-keeping effort. *Transportation Research Part E: Logistics and Transportation Review*, *125*, 425-448.

Yazdi, M., & Kabir, S. (2017). A fuzzy Bayesian network approach for risk analysis in process industries. *Process safety and environmental protection, 111,* 507-519.

Yu, X., & Ren, X. (2018). The impact of food quality information services on food supply chain pricing decisions and coordination mechanisms based on the o2o e-commerce mode. *Journal of Food Quality, 2018.*

Zadeh, L. A. (1965). Fuzzy Sets. *Information and Control, 8,* 338-353.

Zhang, H., Feng, H., Cui, Y., & Wang, Y. (2020). A fuzzy Bayesian network model for quality control in O2O e-commerce. *International Journal of Computers Communications & Control, 15(1).*

Zhang, X., & Wang, T. (2021). Understanding purchase intention in O2O E-commerce: the effects of trust transfer and online contents. *Journal of theoretical and applied electronic commerce research, 16(2),* 101-115.

Zhao, X., Lin, W., Cen, S., Zhu, H., Duan, M., Li, W., & Zhu, S. (2021). The online-to-offline (O2O) food delivery industry and its recent development in China. *European Journal of Clinical Nutrition, 75(2),* 232-237.

Zhu, Y., Wei, Y., Zhou, Z., & Jiang, H. (2022). Consumers' Continuous Use Intention of O2O E-Commerce Platform on Community: A Value Co-Creation Perspective. *Sustainability, 14(3),* 1666.

Zimon, D. (2017). The impact of quality management systems on the effectiveness of food supply chains. *TEM Journal, 6(4),* 693.

References: (books)

Besterfield, D. H., Besterfield-Michna, C., Besterfield, G. H., Besterfield-Sacre, M., Urdhwareshe, H., & Urdhwareshe, H. (2019). Total quality management. 5th ed. New Delhi: Pearson.

Chevrie, F. & Guely, F. (1998). Fuzzy logic. Cahier technique no 191. The "Cahiers Techniques" collection is part of the Groupe Schneider's "Technical series".

Jackson, P., Eckersley, P., & Harris, L. (2003). E-business fundamentals. London: Routledge.

Juran, J. M., & Godfrey, A. B. (1998). Juran's quality handbook.5th ed. New York: McGraw Hill.

Kasabov, N.K. (1997). Foundations Of Neural Networks, Fuzzy Systems, And Knowledge Engineering [Books in Brief]. IEEE Transactions on Neural Networks, 8, 1219-1219.

Keller, J. M. (2016). Fundamentals of computational intelligence neural networks, fuzzy systems, and evolutionary computation. Hoboken, New Jersey: John Wiley & Sons.

Kemp, S. (2006). Quality Management Demystified. New York: McGraw Hill.

Knowles, G. (2011). Quality Management. Graeme Knowles & bookboon.com

Korb, K. B. & Nicholson, A. E. (2011). Bayesian Artificial Intelligence 2nd ed. London: Chapman & Hall/CRC.

Koski, T. & Noble, J. M. (2009). Bayesian Networks An Introduction. Chichester, West Sussex: John Wiley & Sons Ltd.

Kumar, S. (n.d.). Food Quality Management. Indian Culinary Institute, Noida.

NCERT(National Council of Educational Research and Training) (2009). Human Ecology And Family Sciences Part 1. New Delhi : Saraswati Offset Printers.

Nelles, O. (2021). Nonlinear system identification: From classical approaches to neural networks, fuzzy models and Gaussian processes. 2nd ed. Berlin: Springer-Verlag.

New Zealand Government (2018). Food Safety Good Governance Guide for Directors, Executives and Business Owners 2018. Ministry for Primary Industries website at https://www.mpi.govt.nz/news-and-resources/publications/

Rajasekaran, S. & Vijayalakshmi, P. G. A. (2012). Neural networks, fuzzy logic and genetic algorithms: Synthesis and applications. New Delhi: PHI Learning.

Turban, E., Outland, J., King, D., Lee, J. K., Liang, T. P., & Turban, D. C. (2018). Electronic Commerce A Managerial and Social Networks Perspective. 9th ed. New York: Springer.

Will, M., & Guenther, D. (2007). Food Quality and Safety Standards as required by EU Law and the Private Industry–With special reference to the MEDA countries' exports of fresh and processed fruit & vegetables, herbs & spices. 2nd ed. A Practitioners' Reference Book.

Appendices:
Appendix (A): Questionnaire

Deanship of Graduate Studies
Al-Quds University

This questionnaire attempts to collect the data and information necessary to complete a study entitled **"A Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for dairy industry in Palestine"**

In order to fulfill the requirements for earning a master's degree from Al-Quds University in the field of Business Administration, we present to you a list of questions, and we hope that you can answer them truthfully and objectively to provide accurate information that will help us to better results on the subject of study. As it will only be used for scientific study, we pledge to keep this information private.

Thank you for your cooperation.

Researcher: Iman Bajali

First section:

Personal Information:

1.	**The gender**
	Male
	Female
2.	**The age**
	Less than 30
	30-40
	40-50
3.	**Years of experience**
	Less than 5
	5-10
	10-15
	More than 15
4.	**The Academic degree**
	Secondary and below
	Diploma
	Bachelor
	Master's degree and above
5.	**The job title**
	Employee
	Manager
	Other

Second section:

The stage before sending the raw milk to the factory:

1. The number of dairy cows----------
2. The number of times that the cows milked daily
   1. Once
   2. Twice
   3. Three times
3. Average amount of milk produced per day in liters----------

	Yes	No
Is an automated milking system used?		
Is manual milking used?		

Do workers sterilize hands before milking?		
Is the udder of cows cleaned with iodine before milking?		
Is milk from different milking times combined before being sent to the factory?		
Are there plans to increase the proportion of raw milk?		

If there is any plan to increase raw milk production, what will be the focus?

1. Increasing the number of dairy cows
2. Improvement of cow breeds
3. Produce more feed
4. Buy more feed
5. Use of improved types of feed
6. Focus on confronting and controlling cattle diseases
7. Get more outside advice from the experts
8. I do not know exactly
9. Other

If you believe that there are significant (dairy) production constraints on your farm, what constraints do you face with your dairy farm?

1. Low quality forage or bran
2. Low quality concentrated feed
3. High cost of concentrated feed
4. Difficulty buying new cows
5. Agricultural labour shortage
6. Low milk yield
7. Low price of milk in the market
8. Raw milk price fluctuation
9. The temperature needed to preserve raw milk in the farm

10. High prices of livestock feed (concentrated feed)

11. High cost of fresh milk preservation methods

12. High cost of fresh milk preservation methods

13. Diseases affecting animals

14. Other

The stage after sending raw milk to the factory:

	Yes	No
Raw milk is tested before production		
Safety is re-tested after production		

If raw milk is tested before production, what are the tests used?

1. Basic Safety Tests for Milk (Texture, Colour and Odour)
2. Bacterial count test
3. PH test
4. Milk fat test
5. Other tests

The daily rate of milk production in the factory----------

Average time between milking and the entering the manufacturing process----------

What is the effect of this period on the shelf life of milk?

What is the effect of this period on the quality of milk and its products?

Factory temperature in C----------

Equipment is maintained and tested	Daily	Weekly	Monthly	Yearly
The factory is cleaned and disinfected				
Pasteurization equipment is maintained				

The condition of the refrigeration equipment is tested				
Packing equipment is checked				
The quality of containers and milk products is checked				
Storage conditions are checked				

Does the factory implement a quality system? ----------

If yes, what is your system? ----------

Longest product delivery time in hours

1. Less than 4
2. 4-6
3. More than 6

	Yes	No
Delivery trucks equipped with a cooling system		
Delivery trucks have a temperature monitoring system		

Quality of refrigeration in delivery trucks

1. High
2. Medium
3. Low

Unexpected delivery problems have already occurred

Suggested solutions

Taking into account the many problems facing dairy production and increasing its quality, with regard to the solutions and ideas proposed below, do you agree, do not agree, are already being implemented...

	Agree (already used)	Agree (will use)	Neutral	Disagree
The stage of preparing the products				
Offer nutrient-rich food to cows				
Ensure that the cow's feed contains crops and bran				
The use of experts and veterinarians to improve the nutrition of cows				
Maintain cleanliness of feed storage facilities				
Handbook made as a guide for dairy farmers				
Dairy work with small dairy farms				
Using an automated milking system				
Take care to monitor the cowsheds and make plans to manage the risks they face				
Improving the quality of life of cows on farms				
Sterilization and cleaning of cowsheds				

Ensure the implementation of animal health programs				
Cow udder sterilization system				
Production and distribution processing				
Using raw materials (raw milk) from approved suppliers (milk farms)				
Take care to monitor and inspect raw materials (raw milk) to ensure quality				
Ensure that the product meets the standards set by the Palestinian Standards Institution				
Increase the frequency of sample inspection				
Transparency of information exchanged between all parties in the supply chain				
Dairy products meet national and international quality standards				
Automatically control the cooling system				
Availability of backup cooling system				
Sorting process				
Ensure that sorting equipment is in good condition regularly				
Use new technology equipment to ensure that the packaging is leak-proof				

Using different materials other than plastic for packaging dairy products				
A quality assurance system is used				
Delivery links				
Develop market-appropriate delivery plans				
Quality control of products leaving the factory				
Develop a product tracking system				
Maintain proper temperature during delivery process				
Providing the necessary equipment and resources to face problems that may arise during transportation and delivery				

The following statements express the possibility of implementing the idea of (O2O e-business)

	Agree	Neutral	Disagree
Recognized Effectiveness of Online Product Reviews			
We have a website where we display our products.			
We have knowledge of O2O e-business system for online ordering and product delivery.			

Online reviews are reliable and dependable on what people think of our products.			
Online reviews provide accurate information on whether people can order our products online.			
We can send our products abroad based on internet requests.			
The perceived effectiveness of online product descriptions			
The photos and videos available online represent the products in the stores.			
Written descriptions posted online about our products are reliable and accurate.			
The texts, videos and images of our products are constantly updated online.			
Online texts, videos and images help to identify information about our products.			
Trust in merchants			
People consider online shopping to be better and more trustworthy.			
People consider the offline merchant to be able to offer their products better.			
People consider that the offline merchant better fulfils his promises and obligations.			
People consider that an offline merchant has their needs in mind because he knows his customers better.			
Purchasing Intent			
It is important that the website when viewed is attractive and encourages the purchase of a product.			

It is important to make people feel that it is beneficial to buy our products online.			
The experience of buying from the site and products should be unique to motivate people to buy again			
People should be motivated when buying so that they will recommend our site to others.			

We seek to build a model (Fuzzy Bayesian Network Model) to study the possibility of quality management in the dairy industry in Palestine

	Agree	Neutral	Disagree
Main stages related to dairy quality management			
Quality management begins with the preparation stage of the products			
The second stage is related to the processing of raw milk, production of products and then distribution.			
The third stage is the sorting process for different products.			
The last stage is related to the delivery links			
I think there are other stages			
Factors affecting quality at each stage			
The first stage			
Accept inspection			
Barn inspection			
Purchase plan			
Collecting milk			
Unloading			
Receiving			

Barn’s monitoring			
The second stage			
Storing raw milk in coolers			
Raw milk pasteurization			
Cleaning and cooling			
Packing (bottle filling)			
Refrigeration and transportation			
The third stage			
Sorting			
Allocation inspection (ensure that each product is in the allotted place)			
Final packaging			
The fourth stage			
Delivery plan			
Delivery notice			
Outgoing quality control			
Loading			
Transportation and logistics			
Temperature control of the whole process			
Unloading			
Things to take care of at each stage			
Dairy equipment			
Milk collecting tanks			
Unloading equipment			
How much the unloading employees care about quality			
Quality Check			
Temperature monitoring in barns			
Hygienic cleaning in the barns			
Refrigerator in transportation			
Transport emergency backup			
Implementation of laboratory testing at all stages of production			

Packing requirements			
Leak-proof packing			
sorting equipment			
The extent to which the sorting employees care about quality			
Logistics container			
How much operating employees care about quality			
Loading equipment			
Rationality of loading methods			
Sequence of loading			
Car refrigerator malfunction			
Traffic environment			
Temperature control equipment			
How much the delivery staff care about quality			

Appendix (B): Names and Designations of Questionnaire Arbitrators:

	Name	Designation
1.	Dr. Ibrahim Afaneh	Associate Professor
2.	Dr. Omar Slaiby	Assistant Professor
3.	Dr. Orobah Barghouthi	Assistant Professor
4.	Dr. Salah Sawalmeh	Lecturer

Appendix (C): The questionnaire in Arabic

جامعة القدس

كلية الدراسات العليا/إدارة الأعمال

سيداتي/ سادتي

تحية طيبه وبعد...

تهدف هذه الاستبانة الى جمع البيانات والمعلومات اللازمة لإنجاز دراسة بعنوان

"A Fuzzy Bayesian Network Model for Quality Management in O2O E-Business for dairy industry in Palestine "

نتقدم لكم بقائمة من الاسئلة ونرجو الإجابة عليها بدقة وموضوعية لتقديم معلومات دقيقة توصلنا الى نتائج أفضل حول موضوع الدراسة، و ذلك استكمالا لمتطلبات الحصول على درجة الماجستير من جامعة القدس في تخصص إدارة الأعمال.

نعدكم بالحفاظ على سرية هذه المعلومات فهي مخصصة فقط لأغراض البحث العلمي.

شاكرين لكم حسن تعاونكم.

الباحثة: ايمان بجالي.

القسم الأول:

الأسئلة العامة:

1) الجنس: □ ذكر □ أنثى	2) العمر: □ أقل من 30 سنة □ 30 – 40 سنة □ 40 – 50 سنة □ 50 سنة و أكثر	3) سنوات الخبرة: □ أقل من 5 سنوات □ من 5 – 10 سنوات □ من 10 – 15 سنوات □ 15 سنة و أكثر
4) الدرجة العلمية: □ ثانوي فما دون □ دبلوم □ بكالوريوس □ ماجستير فأعلى	5) المسمى الوظيفي: □ عامل مزرعة □ عامل إنتاج □ موظف □ مدير □ مسمى اخر: ----------	

القسم الثاني:

<u>مرحلة ما قبل إرسال الحليب الخام إلى المصنع:</u>

1) كم مرة يتم فيها حلب الأبقار في اليوم؟

1. مرة
2. مرتين
3. ثلاث مرات

2) معدل كمية الحليب الناتج في اليوم باللتر --------

3) عدد الأبقار الحلوب ----------

		نعم	لا
	هل يتم استخدام نظام حلب ألي؟		
	هل يتم استخدام الحلب اليدوي؟		
	هل يقوم العاملون بتعقيم الأيدي قبل الحلب؟		
	هل يتم تنظيف ضرع الأبقار باليود قبل الحلب؟		
	هل يتم دمج الحليب الناتج من أوقات حلب مختلفة معا قبل إرساله للمصنع؟		
	هل هناك خطط لزيادة نسبة الحليب الخام؟		

- اذا كان هناك أي خطة لزيادة إنتاج الحليب الخام، ما المحاور التي سيتم التركيز عليها؟ (يمكن الاختيار حتى 3 خيارات)

1. زيادة عدد الأبقار الحلوب
2. تحسين سلالات الأبقار
3. إنتاج مزيد من الأعلاف
4. شراء مزيد من الأعلاف
5. استخدام أنواع مطورة من الأعلاف
6. التركيز على مواجهة الأمراض التي تصيب الأبقار والسيطرة عليها
7. الحصول على مزيد من النصائح الخارجية من الخبراء
8. لا أعلم بالتحديد
9. أمور أخرى: ----------

- إذا كنت تعتقد أن هناك قيودًا كبيرة على إنتاج (الألبان) في المزرعة، فما هي القيود التي تواجهها مع مزرعة الألبان الخاصة بك.

1. انخفاض جودة العلف أو النخالة
2. انخفاض جودة الأعلاف المركزة
3. ارتفاع تكلفة الأعلاف المركزة
4. صعوبة شراء أبقار جديدة
5. نقص العمالة الزراعية
6. انخفاض جودة الحليب
7. انخفاض إنتاجية الحليب

8. انخفاض سعر الحليب في السوق
9. تذبذب سعر الحليب الخام
10. درجة الحرارة اللازمة لحفظ الحليب الخام في المزرعة
11. ارتفاع أسعار علف الماشية (الأعلاف المركزة)
12. ارتفاع تكلفة أساليب حفظ الحليب طازجا
13. الأمراض التي تصيب الحيوانات
14. أمور أخرى: ----------

مرحلة ما بعد إرسال الحليب الخام إلى المصنع:

		نعم	لا
	يتم اختبار الحليب الخام قبل الإنتاج		
	يتم إعادة اختبار السلامة بعد الإنتاج		

- في حال يتم اختبار الحليب الخام قبل الإنتاج، ما هي الاختبارات المستخدمة؟

1. اختبارات السلامة الأساسية للحليب (القوام واللون والرائحة)
2. العد البكتيري
3. درجة الحموضة
4. نسبة الدهن في الحليب
5. اختبارات أخرى: ----------

- معدل الإنتاج اليومي للحليب في المصنع باللتر ----------
- ما معدل الفترة الزمنية بين الحلب ودخول الحليب لعملية التصنيع ----------
- ما مدى تأثير هذه الفترة على صلاحية الحليب ----------
- ما تأثير هذه الفترة في جودة الحليب و منتجاته ----------
- درجة الحرارة في المصنع ---------- س

	يوميا	أسبوعيا	شهريا	سنويا
يتم صيانة المعدات واختبارها				
يتم تنظيف المصنع وتعقيمه				
يتم صيانة معدات البسترة				
يتم اختبار حالة معدات التبريد				
يتم فحص معدات التعبئة				
يتم فحص جودة الحاويات وحافظات الحليب ومنتجاته				
يتم فحص ظروف التخزين				

- هل يطبق المصنع نظام جودة؟----------
- اذا نعم، فما هو النظام الذي تتبعه؟ ----------

- أطول مدة توصيل للمنتجات

1. أقل من 4 ساعات
2. من 4-6 ساعات
3. أكثر من 6 ساعات

		نعم	لا
	شاحنات التوصيل مجهزة بنظام تبريد		
	شاحنات التوصيل تحتوي على نظام مراقبة للحرارة		

- جودة التبريد في شاحنات التوصيل

1. عالية
2. متوسطة
3. قليلة

- مشاكل توصيل غير متوقعة سبق وحصلت: ----------

- الحلول المقترحة لمواجهتها: ----------

- مع الأخذ في الاعتبار العديد من المشاكل التي تواجه إنتاج الألبان وزيادة جودته، فيما يتعلق بالحلول والأفكار المقترحة أدناه ، هل توافق ، لا توافق ، يجري تنفيذها بالفعل ...

		موافق		محايد	غير موافق
		يتم استخدامها بالفعل	سيتم اعتمادها في المستقبل		
	مرحلة التحضير للمنتجات				
1.	تقديم طعام غني بالعناصر الغذائية الأبقار				
2.	الحرص على أن يحتوي علف الأبقار على المحاصيل والنخالة				
3.	الاستعانة بالخبراء و الأطباء البيطريين لتحسين تغذية الأبقار				
4.	الحفاظ على نظافة مرافق تخزين الأعلاف				
5.	عمل كتيب كدليل إرشادي لمزارعي الألبان				
6.	عمل مصانع الألبان مع مزارع الألبان الصغيرة				
7.	استخدام نظام حلب آلي				
8.	الحرص على مراقبة حظائر الأبقار و عمل				

	خطط لإدارة المخاطر التي تواجهها				
.9	تحسين نوعية حياة الأبقار في المزارع				
.10	تعقيم و تنظيف حظائر الأبقار				
.11	الحرص على تنفيذ برامج صحة الحيوان				
.12	نظام تعقيم لضرع الأبقار				
	معالجة الإنتاج والتوزيع				
.13	استخدام مواد خام (الحليب الخام) من الموردين المعتمدين (مزارع الحليب)				
.14	الحرص على مراقبة وتفتيش المواد الخام (الحليب الخام) لضمان الجودة				
.15	الحرص على أن يلبي المنتج المعايير التي وضعتها مؤسسة المواصفات و المقاييس الفلسطينية				
.16	زيادة وتيرة تفتيش العينات				
.17	شفافية المعلومات المتبادلة بين جميع الأطراف في سلسلة التوريد				
.18	تلبية منتجات الألبان لمعايير الجودة الوطنية و الدولية				
.19	التحكم في نظام التبريد تلقائيًا				
.20	توفر نظام التبريد الاحتياطي				
	عملية الفرز				
.21	التأكد من أن معدات الفرز في حالة جيدة بانتظام				
.22	استخدم معدات تكنولوجية جديدة لضمان أن تكون التعبئة مانعة للتسرب				
.23	استخدام مواد مختلفة غير البلاستيك لتعبئة منتجات الألبان				
.24	يتم استخدام نظام تأكيد الجودة				
	روابط التسليم				
.25	وضع خطط تسليم مناسبة للسوق				

.26	مراقبة جودة المنتجات الخارجة من المصنع				
.27	تطوير نظام تتبع للمنتجات				
.28	الحفاظ على درجة الحرارة مناسبة أثناء عملية التوصيل				
.29	التزود بالمعدات والموارد اللازمة لمواجهة المشاكل التي قد تظهر أثناء النقل والتسليم				

* العبارات التالية تعبر عن إمكانية تطبيق فكرة (O2O e-business)

		موافق	محايد	غير موافق
	الفعالية المعترف بها لمراجعات المنتج عبر الإنترنت			
.30	نمتلك موقع على الإنترنت ونعرض عليه منتجاتنا.			
.31	لدينا معرفة بنظام (O2O e-business) أي نظام الطلب عبر الإنترنت ثم توصيل المنتجات.			
.32	المراجعات عبر الإنترنت موثوقة ويمكن الاعتماد عليها لمعرفة رأي الناس في منتجاتنا.			
.33	المراجعات عبر الإنترنت توفر معلومات دقيقة عن إمكانية طلب الناس لمنتجاتنا عبر الانترنت.			
.34	يمكن أن نقوم بإرسال منتجاتنا للخارج بناءً على طلبات الإنترنت.			
	الفعالية المتصورة لأوصاف المنتجات عبر الإنترنت			
.35	الصور ومقاطع الفيديو المتوفرة عبر الإنترنت تمثل المنتجات في المتاجر.			
.36	الأوصاف المكتوبة المنشورة عبر الإنترنت حول منتجاتنا موثوقة ودقيقة.			
.37	يتم تحديث النصوص ومقاطع الفيديو والصور الخاصة بمنتجاتنا باستمرار عبر الإنترنت.			
.38	تساعد النصوص ومقاطع الفيديو والصور المتوفرة عبر الإنترنت في التعرف على معلومات حول منتجاتنا.			
	الثقة في التجار			
.39	الناس يعتبرون أن الشراء عبر المتاجر أفضل وجدير بالثقة أكثر.			
.40	الناس يعتبرون التاجر غير المتصل بالإنترنت قادر على تقديم منتجاته بشكل أفضل.			
.41	الناس يعتبرون أن التاجر غير المتصل بالإنترنت يفي بوعوده والتزاماته بشكل أفضل.			
.42	الناس يعتبرون أن التاجر غير المتصل بالإنترنت يضع احتياجاتهم في الاعتبار لأنه يعرف زبائنه بشكل أفضل.			
	نية الشراء			
.43	من المهم أن يكون موقع الويب عندما يتم تصفحه جاذب ويشجع على شراء منتج.			
.44	من المهم أن نجعل الناس يشعرون أنه من المفيد شراء منتجاتنا من الإنترنت.			
.45	يجب أن تكون تجربة الشراء من الموقع و المنتجات مميزة لتحفيز الناس على الشراء مجددا			
.46	يجب تحفيز الناس عند الشراء حتى يقوموا بالتوصية بموقعنا للأخرين.			

- نسعى لبناء نموذج (Fuzzy Bayesian Network Model) لدراسة إمكانية إدارة الجودة في مجال صناعة الألبان في فلسطين

		موافق	محايد	غير موافق
	المراحل الرئيسية المتعلقة بإدارة جودة الألبان			
.1	إدارة الجودة تبدأ بمرحلة التحضير للمنتجات			
.2	المرحلة الثانية متعلقة بمعالجة الحليب الخام وإنتاج المنتجات ثم التوزيع.			
.3	المرحلة الثالثة هي عملية الفرز للمنتجات المختلفة.			
.4	المرحلة الأخيرة متعلقة بروابط التسليم			
.5	أعتقد أن هناك مراحل أخرى (في حال الإجابة موافق يرجى إضافة ذلك)			
	العوامل المؤثرة في الجودة في كل مرحلة			
	المرحلة الأولى			
.6	قبول التفتيش			
.7	التفتيش في الحظائر			
.8	خطة الشراء			
.9	جمع الحليب			
.10	التفريغ			
.11	الاستلام			
.12	مراقبة الحظائر			
	المرحلة الثانية			
.13	تخزين الحليب الخام في المبردات			
.14	بسترة الحليب الخام			
.15	التنظيف والتبريد			
.16	التعبئة (تعبئة الزجاجات)			
.17	التبريد والنقل			
	المرحلة الثالثة			
.18	الفرز			
.19	فحص التخصيص (التأكد ان كل منتج في المكان المخصص)			
.20	التغليف النهائي			
	المرحلة الرابعة			
.21	خطة تسليم			
.22	إشعار تسليم			
.23	مراقبة الجودة الصادرة			
.24	التحميل			
.25	النقل والخدمات اللوجستية			
.26	التحكم في درجة حرارة العملية بأكملها			
.27	التفريغ (التنزيل)			
	الأمور التي يجب الاهتمام بها في كل مرحلة من المراحل			

.28	معدات الألبان			
.29	خزانات تجميع الحليب			
.30	معدات التفريغ			
.31	مدى اهتمام أفراد التفريغ بالجودة			
.32	فحص الجودة			
.33	مراقبة درجة الحرارة في الحظائر			
.34	التنظيف الصحي في الحظائر			
.35	الثلاجة في وسيلة النقل			
.36	الطوارئ في وسيلة النقل			
.37	تطبيق الفحص المخبري في جميع مراحل الإنتاج			
.38	متطلبات التعبئة			
.39	التعبئة المانعة للتسرب			
.40	معدات الفرز			
.41	مدى اهتمام أفراد الفرز بالجودة			
.42	حاوية النقل والإمداد			
.43	مدى اهتمام العاملين بالجودة			
.44	معدات التحميل			
.45	منطقية طرق التحميل			
.46	تسلسل التحميل			
.47	خلل في ثلاجة السيارة			
.48	بيئة المرور			
.49	معدات التحكم في درجة الحرارة			
.50	مدى اهتمام موظفي التوصيل بالجودة			