UNIVERSITI PUTRA MALAYSIA

THE DECISION MAKING INDEX ON CULLING COWS IN IRAN

ALI CHIZARI

FP 2013 72

THE DECISION MAKING INDEX ON CULLING COWS IN IRAN

By

ALI CHIZARI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

October 2013

DEDICATIONS

I dedicate this to my dear mother and father

Zahra

Mohammad Ebrahim

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

THE DECISION MAKING INDEX ON CULLING COWS IN IRAN

By

ALI CHIZARI

October 2013

Chair: Prof. Zainal Abidin Mohamed, PhD

Faculty: Agriculture

Agriculture is a competitive industry which means that economic profits will be close to zero in the long run and farmers in agricultural sector need to be agile so as the profit of their agricultural activities need to be maintained. Therefore, effort needs to focus on approaches to maintain profit and the performance of the individual dairy animal in term of milk yield over the period. One of the main decision-making in the dairy farm is; whether to cull or not to cull the animal based on the individual performance especially on milk yield and the overall performance of the farm. This decision-making by farmers or managers on keeping or culling cow is a complex and controversial one. However, the main target for every plan whether to cull or to keep is to improved profitability for now and in the future. Cows exist in the herds based on different reasons and dairy cows will be eventually cull but the time for each cow is specific and it has a direct impact on the animal and farm profitability. Thus culling on time and replacing precisely help to develop herd profitability. On the other aspect, selling heifers as an important resource of providing cash for dairy herds and thus harmony and balance between culling cows, replacing and selling heifers call cull-replace strategy to approach the sustainable profit

in future.

There are four ways to increase profitability on the dairy herd: 1) decreasing cost of production; 2) decreasing assets per unit of producer (dairy cow) ; 3) increasing production; 4) finding the best market with a good price. According to these paths, decreasing cost without attention to the assets per unit of producers is not strong and stable way to generate profit at the farm.

The aim of this study demonstrate that, one of the ways to compute of profitability is return on assets (ROA) which shows the ratio of profit with compare the amount of assets and net revenue. This is obtaining by using the culling-replacement decision and the expected ROA generated for such decision compare to business as usual scenario.

A dairy business has three stages as illustrated that are input, process and output. The most important stage is input which has three steps; Basic (Land and Labor), Purchase Capital (Cow, Machinery and Building) and Intermediate (Services and Feeding). Furthermore, cow as an important purchase capital included approximately 33 percent of the total assets on the farm which needs to renew every year because of cull-replace strategy to keep and protect profit at the farm.

Productivity and efficiency are second reason to use ROA in this study. Efficiency refers to costs and operating profit margin reflects the efficiency of the operation. Productivity relates to a dairy farm's success in generating output (milk, calf) employing a given set of resources (assets) and the assets turnover ratio reflects the farm's productivity. Thus, herd managers ought to range and balance stability between efficiency and productivity to accomplish herd profit. Dairy producers can use two financial measures to assess the productivity and efficiency of their dairy farm business. It means that when considered

these two together (based on formulation) the result is return on assets (ROA). On the other hand, using ROA is involved assets turnover ratio as productivity and operating profit margin as efficiency simultaneously. This explanation clearly shows that dairy producers should not focus their attention solely on cutting cost in order to improve efficiency. The drive for greater efficiency can raise profits, but it also can have the opposite effect when cost cutting results in big declines in productivity. Producers must be aware of the trade-off between productivity (turnings) and efficiency (earnings) as they consider cost-cutting measures.

The computation of profitability is crucial in order to evaluate of assets at differences price between cow and heifer and also different performance in production and operating cost between them. In addition, the cull-replace strategy will also include the amount of the animal assets that will affect the profitability ratio and finally to make culling decision.

The model of most studies based on finding profitability of individual cows in the herd. According to the conceptual framework and variables that need to consider in this study, return on assets (ROA) has selected as a model to estimate a cow's performance.

As explained in the previous paragraphs, procedures of profitability are extensive and based on objectives and available information. Profitability ratios reveal the degree of success or failure over a given period. On the other hand, it is necessary to understand whether the business is spending money efficiently toward making profits or not. About six methods normally being use to analyze the financial performance of a dairy farm. Value of production, net income from operation, net income, and operating profit margin are four methods, which only judge income and cost.

In order to compute cow return on assets milk revenue and pregnancy value as an income and feed cost, mastitis cost, lameness cost, replacement cost, days open cost and breeding cost as a cost and cow assets as an assets have considered.

The results of expenditures are very considerable because, in all past studies most authors focus on feed and days open cost. In our case six other costs were included such as feed cost, breeding cost, mastitis, lameness, days open cost and replacement cost. The result indicates that, feed cost as an important operating cost is in the first place by 51.88 percent (USD1,231.83 average per cow annually) follows by days open cost at 24.31 percent (USD577.22 average per cow annually), replacement cost at 11.72 percent (USD266.48 average per cow annually), breeding, lameness and mastitis cost at 6.33, 4.41and 1.84 percent with USD150.24, USD104.74 and USD43.69 respectively. Thus this study shows that more than 40 percent (41.79 percent about USD992.14) of the operating cost belongs to the hidden or implicit costs which normally not being considered when computing using financial method. As results, without attention to this main part of costs our decision to cull-replace program will be misleading and the farmers can make a wrong decision.

The result of days open cost shows that on average the daily days open cost is USD3.852 on per cow annually. Similarly USD94.07 per cow annually was charged to total days open cost due to delay in pregnancy on culling the cows (16.30 percent).

The quality of cull cows also show that optimization of ROA is much precisely rather than net revenue (NR). Regardless of all changes or the strategy used, there is the need to figure out the quality of the herd. Even though, all variables have a connection with each other, but it is better to evaluate them separately. Regarding the output cows results, the yield of cull cows in the Optimization (OP) is lower than Net Income (NI) index. By

relying on the results, in OP, there are selected high days in milk (240 days), and low Mature Equivalent (ME) milk production (8173 kg) and high number of services (2.9 times) as compare to NI (223 days for Days in Milk (DIM)), 8825 kg ME milk, 2.5 times of services). Furthermore, somatic cell count (SCC), Lameness (locomotion score), and days open in OP strategy are higher than other ways compare to Net Income (187 SCC, 2.3 Lameness, and 184 Days Open, thus with this program (OP), low performance cow can be a candidate to be cull as well.

This study shows that in order to make decision to cull-replace strategy for dairy cows we need to consider main implicit costs such as days open cost, replacement cost, mastitis cost, lameness cost that involved about 40 percent of total cost. Next, to figure out the best performance of the cows and heifers should consider the animal assets. Finally, results demonstrate that with optimization future return on assets can find the best decision to cull and future profit.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

INDEK MEMBUAT KEPUTUSAN TERHADAP PENAKAIAN LEMBU DI IRAN

Oleh

ALI CHIZARI

Oktober 2013

Pengerusi: Prof. Zainal Abidin Mohamed, PhD

Fakulti: Pertanian

Pertanian adalah industri yang berdaya saing yang bermakna keuntungan ekonomi akan menjadi kosong dalam jangka masa panjang dan petani dalam sektor pertanian perlu tangkas supaya keuntungan aktiviti pertanian mereka perlu dikekalkan . Oleh itu, usaha perlu memberi tumpuan kepada pendekatan untuk mengekalkan keuntungan dan prestasi haiwan tenusu individu dari segi hasil susu dalam tempoh tersebut. Salah satu keputusan yang utama di ladang tenusu adalah ; sama ada untuk memusnahkan atau tidak memusnahkan haiwan tersebut berdasarkan kepada prestasi individu terutamanya pada hasil susu dan prestasi keseluruhan ladang. Ini membuat keputusan oleh petani atau pengurus kepada mengekalkan atau membunuh lembu adalah satu kompleks dan kontroversi. Walau bagaimanapun , sasaran utama bagi setiap pelan sama ada untuk memusnahkan atau menyimpan adalah untuk keuntungan yang lebih baik untuk sekarang dan pada masa hadapan. Lembu wujud dalam kawanan berdasarkan sebab-sebab yang berbeza dan lembu tenusu akan akhirnya memusnahkan tetapi masa untuk setiap lembu adalah khusus dan ia mempunyai kesan langsung kepada haiwan dan ladang keuntungan. Oleh itu pemusnahan pada masa dan menggantikan dengan tepat

membantu untuk membangunkan keuntungan kumpulan . Kepada aspek lain , menjual lembu betina sebagai sumber penting dalam menyediakan tunai untuk ternakan tenusu dan dengan itu keharmonian dan keseimbangan antara lembu memusnahkan haiwan ternakan, mengganti dan menjual lembu betina memanggil menyisihkan - menggantikan strategi untuk mendekati keuntungan yang mampan pada masa depan.

Terdapat empat cara untuk meningkatkan keuntungan pada kumpulan tenusu : 1) mengurangkan kos pengeluaran ; 2) mengurangkan aset bagi setiap unit pengeluar (lembu tenusu) ; 3) meningkatkan pengeluaran ; 4) mencari pasaran yang terbaik dengan harga yang baik. Menurut pusat ini , mengurangkan kos tanpa perhatian kepada aset bagi setiap unit pengeluar tidak kuat dan cara stabil untuk menjana keuntungan di ladang itu .

Tujuan kajian ini menunjukkan bahawa, salah satu cara untuk mengira keuntungan adalah pulangan atas aset (ROA) yang menunjukkan nisbah keuntungan dengan membandingkan amaun aset dan pendapatan bersih. Ini adalah mendapatkan dengan menggunakan keputusan membunuh buaya - penggantian dan ROA jangkaan dijana bagi keputusan itu berbanding dengan perniagaan sebagai senario biasa.

Satu perniagaan tenusu mempunyai tiga peringkat seperti yang ditunjukkan yang input, proses dan output. Peringkat yang paling penting adalah input yang mempunyai tiga langkah ; Asas (Tanah dan Buruh) , Pembelian modal (lembu , Jentera dan Bangunan) dan pengantara (Perkhidmatan dan Pemakanan). Tambahan pula, lembu sebagai modal pembelian penting termasuk kira-kira 33 peratus daripada jumlah aset di ladang yang perlu memperbaharui setiap tahun kerana menyisihkan - menggantikan strategi untuk menyimpan dan melindungi keuntungan di ladang itu .

Produktiviti dan kecekapan adalah sebab kedua untuk digunakan ROA dalam kajian ini. Kecekapan merujuk kepada kos dan margin keuntungan operasi mencerminkan kecekapan operasi . Produktiviti berkaitan dengan kejayaan ladang tenusu dalam menjana output (susu , anak lembu) menggunakan satu set sumber (aset) dan nisbah pusing ganti aset mencerminkan produktiviti ladang . Oleh itu , pengurus kumpulan sepatutnya berkisar dan mengimbangi kestabilan antara kecekapan dan produktiviti untuk mencapai keuntungan kumpulan . Pengeluar susu boleh menggunakan dua langkah-langkah kewangan untuk menilai produktiviti dan kecekapan perniagaan ladang tenusu mereka. Ertinya, bila dianggap kedua-dua bersama-sama (berdasarkan formulasi) hasilnya adalah pulangan atas aset (ROA). Sebaliknya , dengan menggunakan Roa terlibat nisbah pusing ganti aset produktiviti dan margin keuntungan operasi kecekapan serentak. Penjelasan ini jelas menunjukkan bahawa pengeluar susu tidak menumpukan perhatian mereka semata-mata kepada memotong kos untuk meningkatkan kecekapan. Usaha untuk kecekapan yang lebih tinggi boleh meningkatkan keuntungan, tetapi ia juga boleh mempunyai kesan yang sebaliknya apabila memotong kos keputusan dalam kemerosotan besar dalam produktiviti. Pengeluar perlu sedar yang keseimbangan antara produktiviti (membuat pusingan) dan kecekapan (pendapatan) kerana mereka menganggap langkah-langkah pengurangan kos.

Pengiraan keuntungan adalah penting untuk menilai aset pada harga perbezaan antara lembu dan lembu betina dan prestasi juga berbeza dalam pengeluaran dan operasi kos di antara mereka. Selain itu, strategi yang menyisihkan - menggantikan juga akan termasuk jumlah aset haiwan yang akan memberi kesan kepada nisbah keuntungan dan akhirnya untuk membuat pemusnahan keputusan.

Model kebanyakan kajian berdasarkan mencari keuntungan lembu individu dalam

kumpulan itu. Menurut rangka kerja konsep dan pembolehubah yang perlu dipertimbangkan dalam kajian ini , pulangan ke atas aset (ROA) telah dipilih sebagai model untuk menganggarkan prestasi lembu.

Seperti yang dijelaskan dalam perenggan yang terdahulu, prosedur keuntungan adalah luas dan berdasarkan objektif dan maklumat yang ada. Nisbah keuntungan mendedahkan tahap kejayaan atau kegagalan dalam tempoh yang diberikan. Sebaliknya , ia adalah perlu untuk memahami sama ada perniagaan itu membelanjakan wang dengan cekap ke arah membuat keuntungan atau tidak. Kira-kira enam kaedah biasanya telah digunakan untuk menganalisis prestasi kewangan ladang tenusu . Nilai pengeluaran , pendapatan bersih daripada operasi , pendapatan bersih, dan margin keuntungan operasi empat kaedah , yang hanya pendapatan hakim dan kos.

Untuk mengira pulangan lembu atas aset pendapatan susu dan nilai kehamilan sebagai pendapatan dan makanan kos, kos mastitis , kos Kepincangan, kos penggantian , hari terbuka dan kos kos pembiakan sebagai satu perbelanjaan dan lembu aset sebagai aset telah mempertimbangkan .

Keputusan perbelanjaan adalah sangat besar kerana , dalam semua kajian lepas penulis yang paling memberi tumpuan kepada makanan dan kos hari terbuka. Dalam kes kami enam kos lain telah dimasukkan seperti kos makanan , kos pembiakan, mastitis, Kepincangan, hari terbuka kos dan kos penggantian. Hasilnya menunjukkan bahawa, kos makanan sebagai kos pengendalian penting adalah di tempat pertama oleh 51,88 peratus (USD1, 231,83 purata setiap lembu setiap tahun) berikut dengan kos hari terbuka pada 24.31 peratus (USD577.22 purata setiap lembu setiap tahun) , kos gantian pada 11.72 peratus (USD266.48 purata setiap lembu setiap tahun) , pembiakan , Kepincangan dan mastitis kos pada 6.33 , 1.84 peratus 4.41 and dengan masing-masing

USD150.24 , USD104.74 dan USD43.69 .. Oleh itu kajian ini menunjukkan bahawa lebih daripada 40 peratus (41.79 peratus kira-kira USD992.14) daripada kos operasi itu adalah milik kos yang tersembunyi atau tersirat yang biasanya tidak dianggap apabila mengira menggunakan kaedah kewangan. Sebagai keputusan , tanpa perhatian kepada bahagian utama kos keputusan kami untuk memusnahkan - menggantikan program akan mengelirukan dan petani boleh membuat keputusan yang salah .

Keputusan hari kos terbuka menunjukkan bahawa rata-rata hari setiap hari kos terbuka adalah USD3.852 pada setiap lembu setiap tahun. Begitu juga USD94.07 per lembu setiap tahun telah dicaj kepada jumlah hari kos terbuka kerana kelewatan dalam kehamilan pada pemusnahan lembu (16.30 peratus).

Kualiti lembu menyisihkan juga menunjukkan bahawa pengoptimuman ROA adalah lebih tepat daripada pendapatan bersih (NR) . Tidak kira semua perubahan atau strategi yang digunakan, terdapat keperluan untuk memikirkan kualiti kumpulan itu. Walaupun, semua pemboleh ubah mempunyai kaitan dengan satu sama lain, tetapi ia adalah lebih baik untuk menilai mereka secara berasingan. Mengenai keputusan lembu output , hasil daripada lembu memusnahkan dalam Optimization yang (OP) adalah lebih rendah daripada Pendapatan Bersih (NI) indeks. Dengan bergantung kepada keputusan, dalam OP, ada dipilih hari tinggi dalam susu (240 hari), dan matang Setaraf rendah (ME) pengeluaran susu (8173 kg) dan bilangan tinggi perkhidmatan (2.9 kali) berbanding dengan NI (223 hari Days dalam susu (DIM)), 8825 kg susu ME, 2.5 kali perkhidmatan) . Tambahan pula, sel somatik (SCC) , Kepincangan (pergerakan skor) , dan hari terbuka dalam strategi OP adalah lebih tinggi daripada cara lain berbanding dengan pendapatan bersih (187 SCC , 2.3 Kepincangan, dan 184 Hari Terbuka, dengan itu dengan program ini (OP), lembu prestasi yang rendah boleh menjadi calon untuk menjadi menyisihkan juga.

Kajian ini menunjukkan bahawa untuk membuat keputusan untuk memusnahkan - menggantikan strategi untuk lembu tenusu kita perlu mengambil kira kos utama yang tersirat seperti hari kos terbuka , kos gantian, kos mastitis , kos Kepincangan yang melibatkan kira-kira 40 peratus daripada jumlah kos . Seterusnya, untuk memikirkan prestasi yang terbaik daripada lembu dan lembu betina harus mengambil kira aset haiwan. Akhirnya , keputusan menunjukkan bahawa dengan pengoptimuman pulangan masa depan ke aset boleh mencari keputusan yang terbaik untuk memusnahkan dan keuntungan masa depan.

ACKNOWLEDGEMENTS

I would like to acknowledge the contributions of the following groups and individuals to the development of my project:

First, I would like to extend my sincere appreciation to my supervisor, Prof. Dr. Zainal Abidin Mohamed. Without his guidance, patience, direction, and assistance, this thesis would not have been possible. I would equally like to thank my committee member, Dr. Ismail Abd Latif who provided magnificent direction and insight into this project.

To my dear brothers, Dr. Hassan Chizari and Hossain Chizari (a PhD candidate at Universiti Sians Malaysia) who have cared and supported me especially here in Malaysia.

To my dear wife, Maryam that words are not enough to express my sincere appreciation for all you have done for me.

I certify that a Thesis Examination Committee has met on October 2013 to conduct the final examination of Ali Chizari on his thesis entitled "The Decision Making Index on Culling Cows in Iran" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

Norsida binti Man, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Mohd Mansor bin Ismail, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Internal Examiner)

Golnaz Rezai, PhD
Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Internal Examiner)

Yusman Syaukat, PhD
Associate Professor
Bogor Agriculture University
Indonesia
(External Examiner)

NORITAH OMAR, PhD
Associate Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 19 December 2013

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science.

The members of the Supervisory Committee were as follows:

Zainal Abidin Mohamed, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairperson)

Ismail Abd. Latif, PhD
Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

BUJANG BIN KIM HUAT, Ph.D.
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously nor concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

ALI CHIZARI

Date: 9 October 2013

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABCI	Animal Breeding Centre of Iran
AI	Artificial Insemination
BM	Base Milk
CR	Conception Rate
CRC	Cow Replacement Cost
DIM	Days In Milk
DO	Days Open
DOP	Days Of Pregnancy
DSS	Decision Support System
EH-ROA	Expected Heifer ROA
FP-ROA	Financial Position
EH-NI	Expected Heifer NI
ES	Expert System
HA-ROA	Herd Average
HDR	Heat Detection Rate
HRC	Herd Replacement Cost
HTR	Herd Turnover Rate
ME	Mature Equivalent
NIFO	Net Income From Operation
OPM	Operating Profit Margin
PR	Pregnancy Rate
ROA	Return On Assets
ROE	Return On Equity
ROI	Return On Investment
VOP	Value Of Production

CHAPTER 1
GENERAL INTRODUCTION

1.1 Introduction

Iran is a country strategically placed in the Middle East. The name ”Iran” which signifies the ”Land of the Aryans” is home to one of the world’s oldest civilizations. Iran is the eighteenth largest country in the world in terms of land size at 1,648,195 square km and has a population of around seventy nine million. Tehran is the capital, the country’s largest town and therefore the center of political, cultural and industrial activity. The country is also a regional power and holds a very important position in the international energy security and world economy as a result of its giant reserves of oil and gas. It also has the second largest gas reserves and the fourth largest oil reserves in the world (Ilias, 2010).

The population is young with about 50% aged below 20 years and growth rate of 1.3%. The urban population and villagers account for 68.4 and 31.4% of the total population, respectively while nomads comprise the remaining 0.2%. The male: female ratio is 103 men to 100 women. A wide spectrum of environmental conditions exist, from the areas of higher rainfall around the Caspian sea, high elevations in the north and west and the subtropical climates in the south, to the drier steppe and desert areas in the central region. Temperatures vary greatly, ranging from -30°C in certain parts of the Northwest, to +55°C in the desert areas and the Persian Gulf region (Somervill, 2012).

1.2 Overview of Economy of Iran

The economy of Iran is the 25th largest in the world by value (nominal) and the classifies Iranian’s economy as semi-developed and the eighteenth largest economy in the world by purchase power parity (PPP). Agriculture is a major economic sector

in Iran, with great potential for development and as such, is seen as a key strategic policy area. It contributes more than 25% of GDP and one-third of total employment. It also contributes substantial export earnings i.e., one-third of total non-oil export (Kamalzadeh et al., 2008).

Table 1.1 and 1.2 show general information about of Iran, GDP (Gross Domestic Product) and development (CIA World Factbook, 2012; Global Finance, 2012). As it was shown, real GDP does not have steady trend during 2005 to 2012. Real GDP has its maximum in 2007 with 7.8% and its minimum in 2012 with 0.4% as well as increase in inflation from 2009 (10.8%) to 2012 (21.8%). Now, Iran is a large-developing country with limited resources for investment and really needs to determine the key sector of its economy to correctly find its own way of improving and becoming a developed country. Iran national accounts show that, yearly investment for NA-Manufacturing (Non Agriculture Manufacturing) sector has been more than twice as many as for Agriculture sector during 1991-2007, Figure 1.1; but the ratio of Value Added to Investment in each of the sectors, for Agriculture is obviously more than NA-Manufacturing sector in each year during this period, Figure 1.2. This very interesting fact makes it clear that investing on NA-manufacturing sector had not had the productivity that it would be hoped (PourKazemi and Eftekharzadeh, 2011).

As displayed in Table 1.2 the livestock sector is one of the largest sectors in agriculture of Iran with 30% contribution to the GDP economy. Although, oil and manufacturing industries contributing about 40.6% to the GDP (oil price increased) but most of the investment in agriculture sector is by the private sector as opposed to the government investment in oil and other industries (Statistic Centre of Iran, 2009).

Table 1.1: Iran Country Report: GDP data and GDP forecasts; economic, financial and trade information 2010 part 1

Item				Value				
Real GDP growth	2005	2006	2007	2008	2009	2010	2011	2012*
	4.7%	5.8%	7.8%	0.6%	4%	5.9%	2%	0.4%
GDP (PPP) - share	1980	1990	2000	2010	2015**			
of world total	1.01%	1.05%	1.03%	1.27%	1.13%			
Inflation	2009	2010	2011	2012*				
	10.8%	12.4%	21.3%	21.8%				

(Source: CIA World Fact book, 2012; Global Finance, 2012)
*Estimate
**Forecast

Table 1.2: Iran Country Report: GDP data and GDP forecasts; economic, financial and trade information 2010 part 2

Item	Value
Gross Domestic Product - GDP	USD496.243 billion
GDP (Purchasing Power Parity)	USD1.007 trillion
GDP per capita - current prices	USD6,445
GDP per capita - PPP	USD13,072
Investment (gross fixed):	27.6% of GDP
GDP - composition by sector	
Agriculture:	11.2%
Livestock:	30% of Agri-GDP
Industry:	40.6%
Services:	48.2%
Labor force - by occupation:	
Agriculture:	25%
Industry:	31%
Services:	45%

(Source: CIA World Fact book, 2012; Global Finance, 2012)

1.3 Overview of Agriculture in Iran

Roughly one-third of Iran's total surface area is suited for farmland but because of poor soil and lack of adequate water distribution in many areas most of it is not under cultivation. Only 12% of the total land area is under cultivation (arable land, orchards and vineyards) but only less than one-third of the cultivated area is irrigated and the rest is devoted to dry farming and rain fed. Some 92% of agro products depend on water the

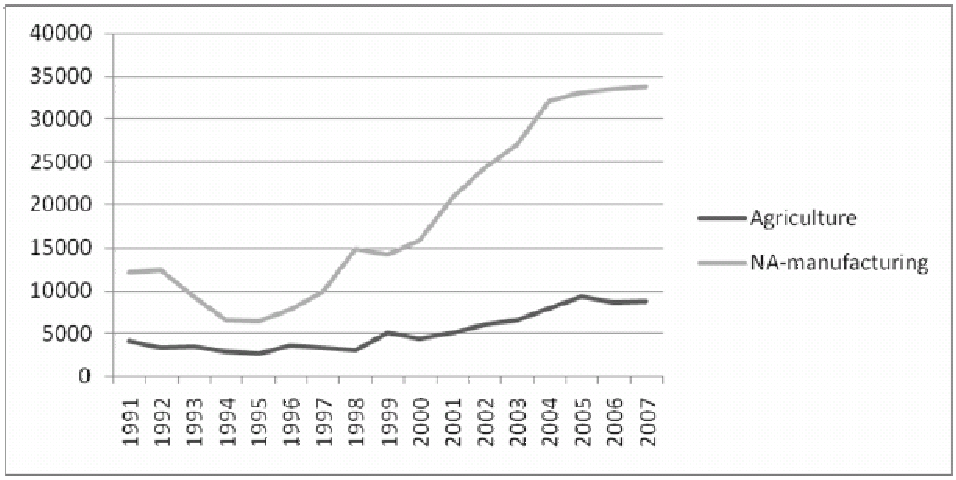

Figure 1.1: Yearly investment (USD) for each sector during (1991-2007)

(Source: PourKazemi and Eftekharzadeh, 2011)

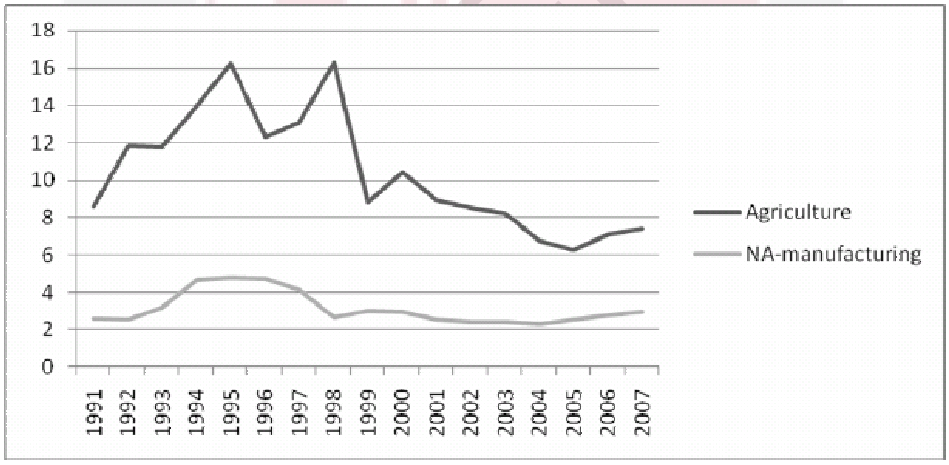

Figure 1.2: Ratio of value added to investment for each sector during (1991-2007)

(Source: PourKazemi and Eftekharzadeh, 2011)

western and north-western portions of the country have the most fertile soils. Iran's food security index stands at around 96%. Most of the grazing is done on semi-dry rangeland in mountain areas and on areas surrounding the large deserts ("Dashts") of Central Iran. The non-agricultural surface represents 53% of the total area of Iran. This is broken down as about 35% covered by deserts, salt flats ("kavirs") and bare-rock mountains.

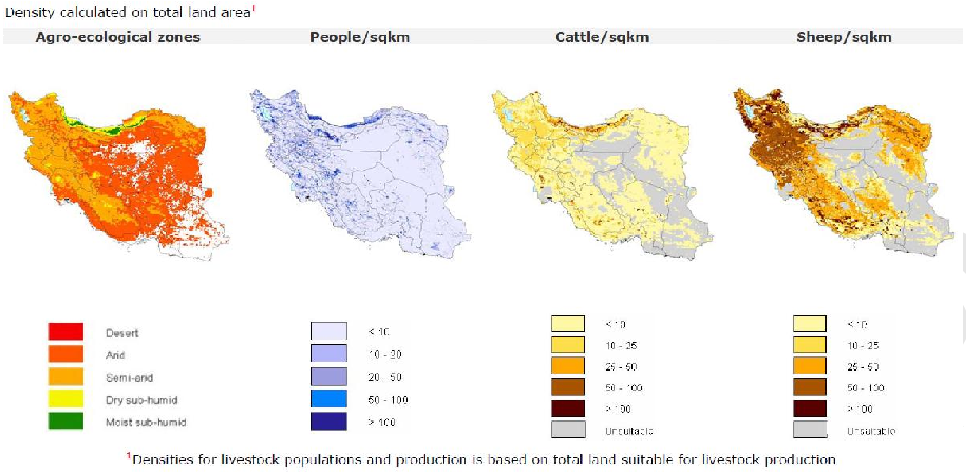

Figure 1.3: Iran, Agro-ecological zones and densities of cattle

(Source: FAO, 2005)

An additional 11% of Iran's total surface is covered by woodlands and 7% is taken by cities, towns, villages, industrial areas and roads (Farzaneh, 1994).

At the end of the 20th century, agricultural activities accounted for about one-fifth of Iran's gross domestic product (GDP) and employed a comparable proportion of the workforce. Most farms are small, less than 25 acres (10 hectares) and not economically viable, contributing to a wide-scale migration to cities. In addition to water scarcity and areas of poor soil, seed is of low quality and farming techniques are antiquated. All these factors have contributed to low crop yields and poverty in rural areas (Ilias, 2010).

Iran's population can be considered largely free from food insecurity. The food balanced sheet showed an increase in net energy supplies from 2800 to 3160 call per capita per day. The quantity of per capita protein went up from 73 to 80 g per day. In spite of such progress in terms of energy and protein availability, unbalanced diets and micro-nutrients deficit remain serious problems (Stads et al., 2008).

Agricultural policies over the last two decades have sought to strengthen agricultural activity in order to achieve higher levels of food production and more diversified sources of foreign exchange thus reducing vulnerability to oil development price fluctuations. The government has actively supported the rural sector and agricultural production. Two key aspects of this strategy have been ensuring guaranteed prices to the producers for selected crops and products and a strong effort towards rural benefiting thousands of villages (Kamalzadeh et al., 2008).

1.4 Overview of Livestock Industry in Iran

Livestock is an important national resource in Iran. More than half of the rural population depends at least in part on livestock for their livelihood Table 1.3 (Kamalzadeh et al., 2008). Livestock plays a key role in the lives of the rural poor,

Table 1.3: Livestock numbers in Iran, 2002-2009 (1000 head)

Years/Species	2002	2004	2006	2009 (Expected)	Annual growth (%)
Sheep	51701	52115	52271	52114	0.11
Goats	25551	52756	25833	25756	0.11
Cattle(PE)	683	753	830	961	5
Cattle(CB)	2425	2839	3438	4373	8.79
Cattle(LB)	4337	4039	3624	295	-5.5
Buffalo	383	402	424	459	2.62
Camel	147	150	152	154	0.67
Other	1727	1727	1571	1724	0.11

PE: Pure Exotics, CB: Cross-breeds, LB: Local Breeds
(Source: Kamalzadeh et al., 2008)

generating employment and often providing about 80% of their cash income. On average, 31.8% of the gross value of agricultural production is attributed to livestock production, which provides the main source of income and an important component of the average diet. Production of milk, red meat, poultry meat and eggs has increased during the last decade by 7.19, 3.14, 7.92 and 5.37% annually, respectively as shown in Table 1.4. Guaranteed and remunerative producer-prices for major commodities have

Table 1.4: Livestock production, 2002-2009 (1000 ton)

Products	2002	2004	2006	2009 (Expected)	Annual growth (%)
Milk	5877	6720	7749	9556	7.19
Red meat	741.6	847.9	838.1	922	3.14
Poultry meat	941.5	1171	1360	1605	7.92
Eggs	547.03	645	676	789	5.37

(Source: Kamalzadeh et al., 2008)

been the essential policy tool behind such performances. Milk production has grown as a result of improved yields and expanding herd size. Livestock by-products such as hides, intestines, hair and related products constitute also part of the country's exports (Stads et al., 2008). According to the Figure 1.4, most of the production provided the consumption of livestock products except milk production that is well over the demand for consumption (FAO, 2005).

Table 1.5: Export/import dependency for livestock products

Product	Exports as percentage of production				Imports as percentage of consumption			
	1980	1990	2000	2002	1980	1990	2000	2002
Meat, Total	0.10	0.00	0.47	0.79	21.90	12.55	1.98	0.82
Beef and buffalo	0.34	0.00	0.01	0.00	26.01	36.24	2.8	3.36
Sheep and goat	0.00	0.00	0.03	0.00	32.86	4.26	0.06	0.00
Pig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poultry	0.00	0.00	0.87	1,49	2.82	0.00	2.70	0.32
Milk, equivalent	0.00	0.00	0.17	0.37	83.16	45.26	9.49	10.91
Eggs, total	0.00	0.00	6.69	3.16	12.83	0.00	0.05	0.07

(Source: FAO, 2005)

The exports and imports of livestock products in 2002 also (Table 1.5) shows that the imports have declined from 4.8 to 0.2% over a 12 year (from 1980 to 2002) period. However, exports of livestock products remained slightly constant (FAO, 2005).

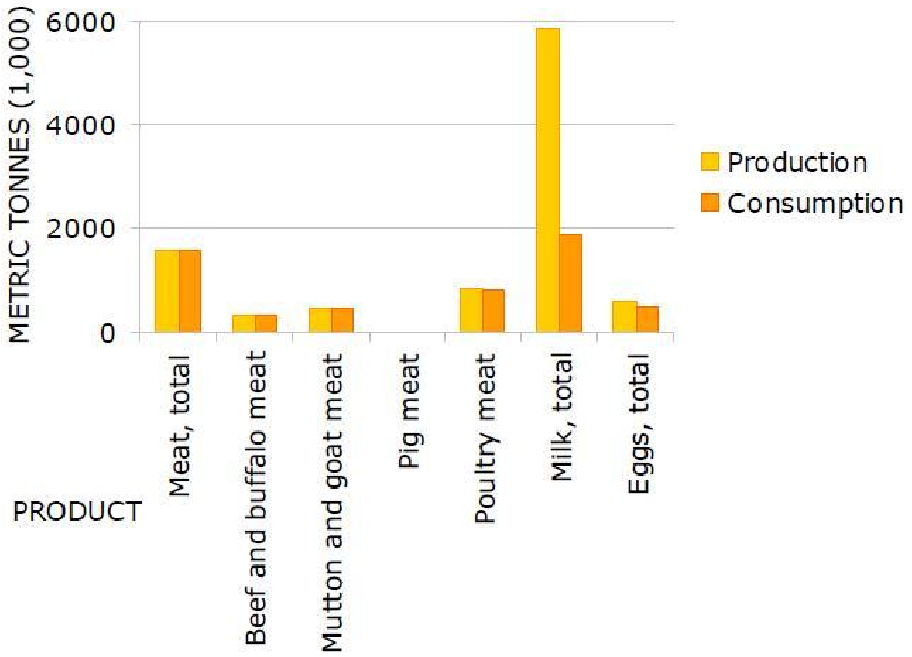

Figure 1.4: Iran, Production versus consumption for meat, milk and eggs (2002)

(Source: FAO, 2005)

1.5 Dairy Industry in Iran

One of the biggest divisions of the agriculture sector is the dairy industry and the Iranian dairy herd includes 842,000 Holstein cows on commercial dairy farms (Kalantari et al., 2010).

Importation of Holstein registered heifers from Europe, the United States, and Canada during the 1970 's and early 1980 's was the precursor to the establishment of intensive dairy cow husbandry in Iran. An official livestock improvement organization called the Animal Breeding Center of Iran (ABCI in Karaj, Iran) was developed and tasked with the expansion and improvement of the Holstein population. A variety of traits including milk production, reproductive performance and conformation traits have been systematically collected by ABCI (ABCI, 2011).

At present, there are three categories of cattle breeds: pure exotic, cross breed of native and exotics and pure native breeds. The number of native cows is about 3.5 million heads and reared in villages mostly under a traditional system. It is estimated that the herd size for each family is about 4 to 5 cattle. The cows are allowed on the natural communal grazing lands or irrigated farmlands. Part of the annual fodder requirements are provided by vegetation lands throughout the year (Stads et al., 2008).

Since 55 years ago, some exotic cattle breeds such as Holstein, Brown Swiss, Jersey, Guernsey and Red Danish were imported. However, at present, the Holstein is the most popular and dominating breed and a few dairy farms are rearing Brown Swiss and Jersey breeds. The infrastructure necessary for genetic improvement of these cattle, such as pedigree registration, recording the traits and artificial insemination has been organized since 45 years ago (FAO, 2011).

The animal breeding center a few kilometers from Tehran is situated in Karaj. It is in charge of dairy herd's milk recording, data analysis, breeding value estimation for the dairy cows, embryo transferring and semen collection from proven sires, freezing semen and distribution to the farms. For the last 25 years, there has been an improvement in the productivity of the industrial dairy herds to reach an acceptable level. The average daily milk production is about 29 kg per cow. These herds which are members of the milk-recording program use semen of proven sires through artificial insemination or embryo transfer techniques (Kamalzadeh et al., 2008).

In Iran, the dairy cattle population has been increasing in both herd number and size. Iranian dairy farms vary in scale from small farms with less than 100 cows to large farms with 7,000 cows and an overall average herd size of 680 cows. Holstein cows are the main dairy breed used in intensive dairy farm systems producing more than

90% of milk sold on the free market. Approximately 800 thousands Holstein cows are registered which represents 12.5% of the total national cattle population (Agriculture Ministry of Iran, 2008). Generally and irrespective of herd size intensive production

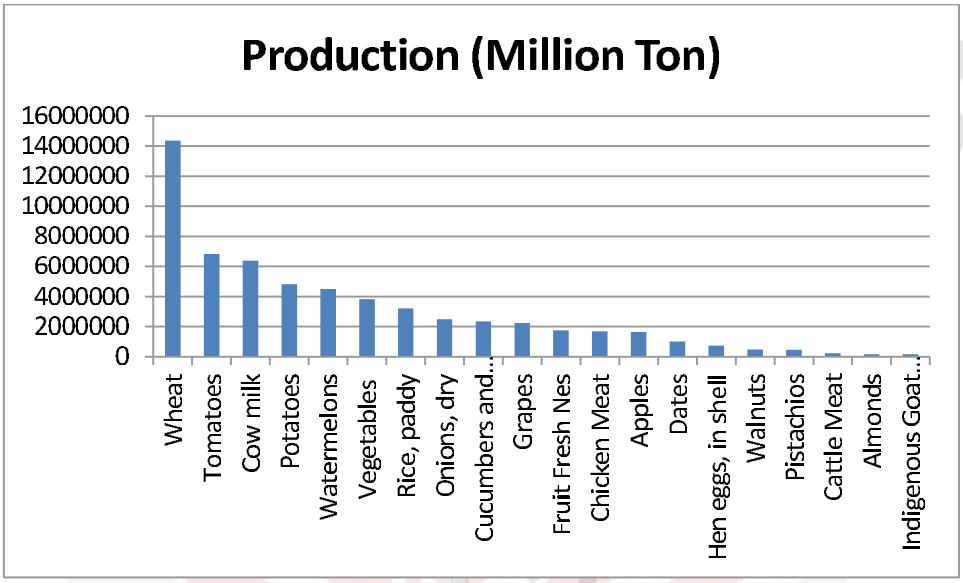

Figure 1.5: Agriculture commodities in Iran based on production (million ton), 2011

(Source: FAO, 2011)

systems use open-shed and free stall barn housing systems. Almost all of the farms employ nutritional experts and use feed rations relatively high in concentrates, with alfalfa and corn silage contributing roughage (Sadeghi-Sefidmazgi et al., 2012).

Currently in Iran, the milk pricing system is based on a price per kilogram of base milk (BM) and a percentage of differential premiums based on the fat and protein content of milk. There are large differences in milk payment systems among Iranian dairy processors. Most milk processors place minimal pricing emphasis on milk components, especially protein and Somatic cell count (SCC). The BM is defined as 1 kg of milk with 3.2% fat and 3% protein. Marketing plays an important role in the price of BM.

However, the accessory payments for each percent of fat and protein are the same in milk markets (Sadeghi-Sefidmazgi et al., 2011).

Cow milk production is one of most important segments of dairy industry. Based on a study by FAO (2009) and illustrated in Figures 1.5 and 1.6, cow milk has the third place for value and amount of produced among agriculture commodities. By comparison, Iran produces about 10 million tons of milk and ranking 19th globally and 4th in Asia after India, China, and Pakistan Figure 1.7 (Dairy Co, 2010). However, unstable milk prices

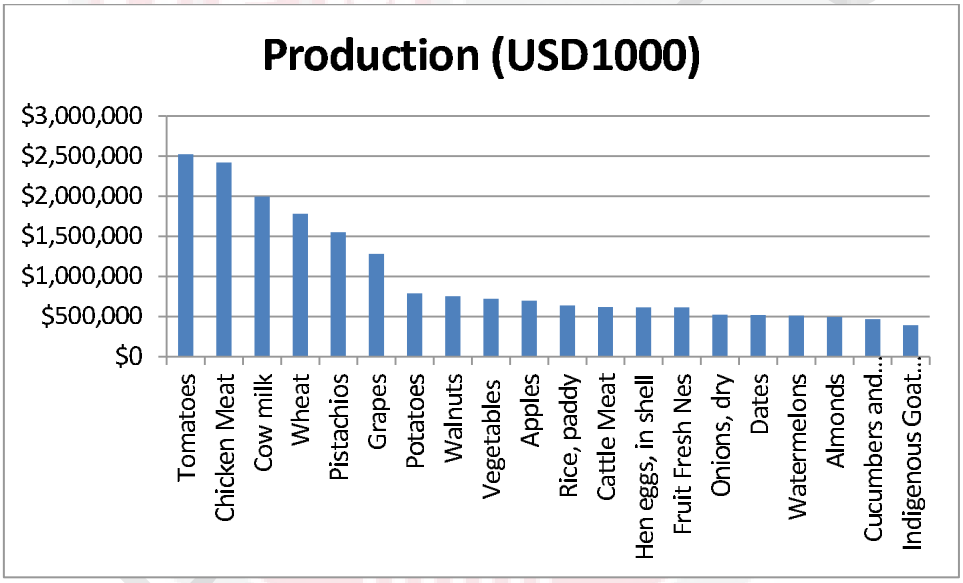

Figure 1.6: Agriculture commodities in Iran based on value (USD), 2011

(Source: FAO, 2011)

and lack of government financial support leads to changing output and input prices. Moreover, import of cheap meat is another reason for the cost of replacement in Iran to stand much higher as compared to the United States (Kalantari et al., 2010). That is why decision making regarding development of the herd is very difficult and at times impossible.

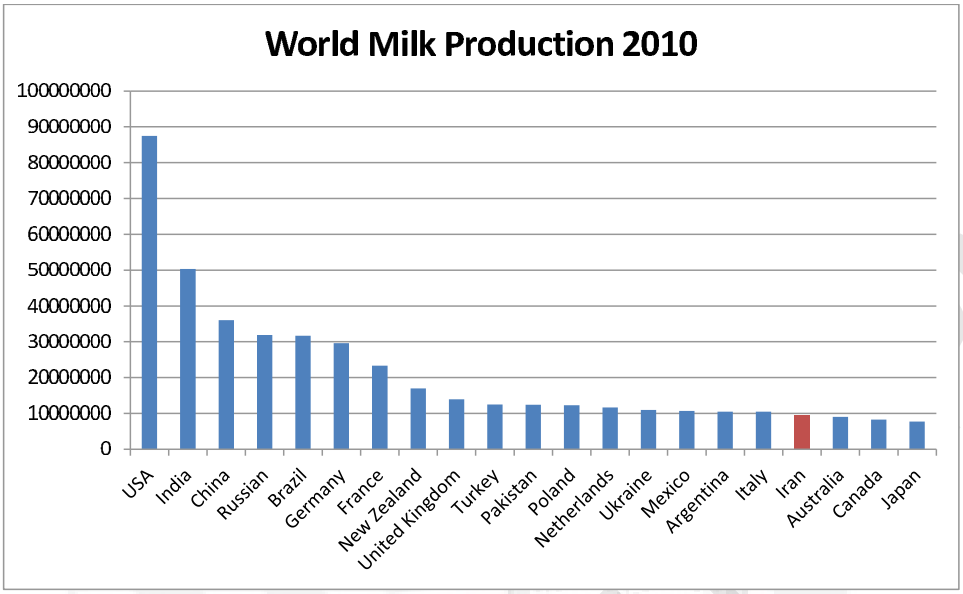

Figure 1.7: World Milk Production Ranking

(Source: Dairy Co, 2010)

1.6 Economics of Culling Cows

Approximately, every year one-third of cows are culled from the global herd population either through voluntary or involuntary procedures. Voluntary culling is a mean to manage and achieve goals based on the strategic planning of the herd. This can be done through selling of animals for dairy purpose such as milk production and pregnancy. However, the decision toward involuntary culling of animals is initiated matters concerning injury, death and incurable diseases (Tuberculosis, Anthrax, Mastitis, Lameness) (Banaeian, 2011).

Mohammadi and Sedighi (2009) showed that the average annual culling rate in Iran is 13.1% (98.8% involuntary, 1.5% voluntary). The main reasons for this in order of frequency are low production, poor fertility, mastitis and lameness. Furthermore it is worth noting that involuntary culling of cows is very costly for the farmers as opposed

to voluntary which occasionally bring in more profit (Kalantari et al., 2010). Therefore an approach to reduce involuntary culling while considering other related variables lead farmers to generate money and obtain profitability on the farm. This shows that there is no specific policy or systematic process to make decisions or improve performance and profitability. In addition, farmers do not have a program or tool to measure profitability of cows because of various reasons for culling. What seems to be happening is that the farmers just keep the cows till the time for involuntary culling arrives.

These results show that for the herders the main target is to produce milk and they tend not to pay attention to other variables which could impact the output by cows and impact economic losses.

The above discussion shows that despite outstanding capabilities linked with the market, managerial skills and cow's productiveness attention to the economic performance of herds is missing.

Most studies indicate that decreasing involuntary culling can improve revenue of the herd. In other words, involuntary culling increases the maintenance cost of the cow and then impact the costs associated with the herd. Reducing involuntary culling rates by 2.9% has resulted in about USD22 and more net revenue per cow per year (Rogers et al., 1988).

The dairy industry is one of the largest businesses which need large investments in the agriculture sector. The number and variety of the animals within a herd can call for building of new or different barns with relevant equipment on a greater size of land. Milking system, nutrition system (like feeder, mixer), ventilation system, manure collection, labor house and other facilities are just some part of the infrastructure that

needs preparation before enhancing the business. According to a report by the Ministry of Agriculture about 27% of assets are related to dairy animals, while for machinery, buildings and farmland it is over 50% (Agriculture Ministry of Iran, 2008, 2010).

From another aspect, the economic limitation with the cow's life created a need to cull or remove some uneconomical animals (heifers) (Culling Rate) each year (Figure 1.8). However, differences in the price of culled cow and heifers mean that every year new

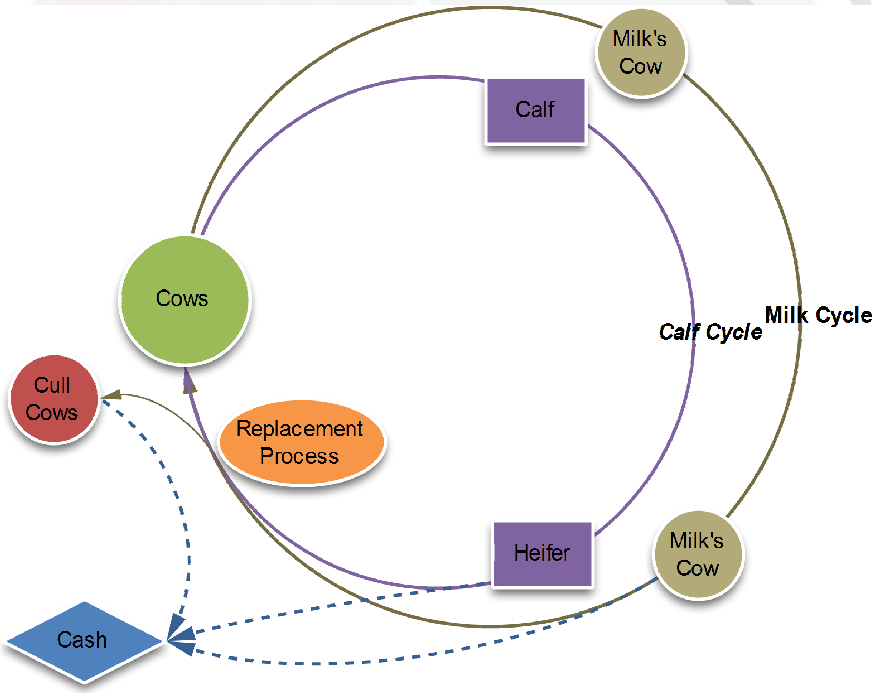

Figure 1.8: Cow Economic Life Cycle

investment is needed for the main asset of the farm or the cows to stay healthy and productive.

Overall different reasons for culling, market price fluctuation and ability to manage the herd could make the decision to remove cows a complex task and a controversial subject for the herders.

1.7 Problem Statement

Breeding of livestock in Iran is a fundamental sector of the Iranian agriculture industry and rearing cattle especially dairy cattle for milk production is of strategic importance. It is then clear that this industry plays a great role in the economy of the villages making the economic aspect of the dairy herd a focus of particular interest.

The main task of keeping dairy herd is for it to generate money so profitability is an important benchmark for measuring its success. Closely related to this goal are the different reasons for culling cows which in turn impacts costs and profits thus making judgements and decisions to remove cows a burdensome task. In addition, the market price of the supplies and products are affected with this plan simply because of its influence on revenue and expenditures at the farm.

Furthermore, economic yield of the herd could be taken as a fundamental point to continue the farm business and recognize the points of weakness. In line with this is attention given to costs specifically production costs as compared to assets being used on the farm. Based on this there is a need for the creation of a tool to evaluate and assess the cow's performance and indulge on the decision to keep or cull the cows.

Given the importance of the livestock industry and it association with the economics of agricultural and that of dairy farming and milk production. The use of new tools and methods to increase productivity and performance are indispensable. One of the factors to reduce production costs while raising dairy cattle is livestock identification and distinguishing high-quality or low productivity animals and removing them from the herd.

Once the decision is taken to reduce production costs and use capital efficiently,

improvements show in terms of riding capital. Livestock identification and its assessment should be based on the economic conditions of the market and biological characteristics of the affected animal. Based on the current economic conditions and the absence of a practical system of assessment and decision making, related operations are not being carried out properly on the farms.

1.8 Research Objectives

Overall the objective is to create a culling cow index in order to increase farm productivity and profit for dairy farmers.

Specific Objectives

1) To investigate the factors that influence the performance and value of dairy cows
2) To develop a decision making software in culling dairy animals
3) To make decision on culling dairy animals with the Culling Index

1.9 Significant of Study

This study will provide the dairy farmers a strategic insight for the management of dairy herds such as decision making on when to sell the heifers or culling cows as means of providing a cash flow based on herd size.

It will help farmers to reduce production costs through culling of under performance cows. As there are a number of the variables that impact the performance of the cows, having this software to assess and analyse data is practical as it makes the task more tangible and fast. This is because it will be able to consider a wide range of alternatives which affect the yield of dairy cows.

There are also recommendations provided on how to evaluate the development of a dairy

farm. Return on investment (ROI) and return on assets (ROA) are considered as the two significant benchmarks to draw plans and assist managers with their decision making in the future.

1.10 Organization of The Thesis

In this study, in chapter one I have a glimpses to economic situation and agriculture position in Iran and assess culling method and reasons in dairy industry. Continuously, in chapter 2 I discuss and assess past studies concern this research and analyse the past models and methods and variables that previous studies have used. After that, I explain about specific method which have chosen in this study and how to compute all revenues and costs for each cow and how to compare between cows. In chapter 4, I analyse the results and compare with past studies. In chapter 5 I talk about conclusions and recommendation and the policy implication.

BIBLIOGRAPHY

ABCI (2011). Animal Breeding Centre of Iran: Operation Record. Technical report.

Agriculture Ministry of Iran (2008). Statistical Year Book (2008). *http://www.iran-daily.com, agriculture ministry*, (1):1–740.

Agriculture Ministry of Iran (2010). Internal Bulliten 2010. Technical report.

Allore, H. G., Jones, L. R., Merrill, W. G., and Oltenacu, P. a. (1995). A decision support system for evaluating mastitis information. *Journal of Dairy Science*, 78(6):1382–98.

Amadou, Z., Ward, C. E., and Bello, H. M. (2009). Econometric estimation of profitability of cull cows in cow-calf enterprise: An application of a management production systems strategy. In *Conference of the African Econometrics Society, 8 10th July 2009*, volume 63059082, pages 8–10.

Amundson, J. L., Mader, T. L., Rasby, R. J., and Hu, Q. S. (2006). Environmental effects on pregnancy rate in beef cattle. *Journal of Animal Science*, 84(12):3415–20.

Ashwood, A. (2001). Improving Herd Management. *NSW Agriculture*, pages 40–56.

Banaeian, N. (2011). Do the cattle farms of Iran produce economically efficient or not ? *Asian Journal of Agricultural Sciences*, 3(2):142–149.

Bascom, S. S. and Young, A. J. (1998). A summary of reasons why farmers cull cows. *Journal of Dairy Science*, 81:2299–2305.

Bethard, G. and Nunes, A. L. (2011). Are you efficiently replacing your herd ? In *Western Dairy Management Conference*, pages 53–65.

Booth, C. J., Warnick, L. D., Hn, Y. T. G. ., Maizon, D. O., Guard, C. L., and Janssen, D. (2004). Effect of lameness on culling in dairy cows. *Journal of Dairy Science*, 87:4115–4122.

Bruce, J. (2011). Do not cut cost at the expense of profitability. *http://www.dairyherd.com/dairy-herd/tools-for-profit/dont-cut-cost-at-the-expense-of-profitability-114041429.html*, pages 1–2.

Cady, R. (2005). The impact of timing of the culling event on profitability in dairy herds. *Journal of Dairy Science*, 88:122–124.

Caraviello, D. Z., Weigel, K. a., Craven, M., Gianola, D., Cook, N. B., Nordlund, K. V., Fricke, P. M., and Wiltbank, M. C. (2006). Analysis of reproductive performance of lactating cows on large dairy farms using machine learning algorithms. *Journal of Dairy Science*, 89(12):4703–22.

CIA World Factbook (2012). Iran's Economy 2012.

Cole, J. B., Null, D. J., and Vanraden, P. M. (2009). Best prediction of yields for long lactations. *Journal of Dairy Science*, pages 1796–1810.

Congleton, W. R., Corey, A. R., and Roberts, C. A. (1988). Dairy cow culling decision . 1 . Techniques for evaluating the effect on herd income. *Journal of Dairy Science*, 71:1897–1904.

Cook, C. (1988). *Sampling Theory*.

Dairy Co (2010). Market Intelligence Monthly Market Report. *http://www.dairyco.org.uk/resources-library/market-information/supply-production/world-milk-production/*, pages 1–24.

DCRC (2005). High production , low fertility ? *Dairy Cattle Reproduction Council (DCRC)*, pages 1–2.

De Vries, A. (2002). What is the value of getting a cow pregnant? In *Proceedings Florida Dairy Production Conference, Gainesville, FL, April 30-May 1*, pages 75–88.

De Vries, A. (2006a). Determinants of the cost of days open in dairy cattle. In *Proceedings of the 11th International Symposium on Veterinary Epidemiology and Economics, Cairns, Australia, August 6-11*, volume 41, pages 19–20.

De Vries, A. (2006b). Economic value of pregnancy in dairy cattle. *Journal of Dairy Science*, 89:3876–3885.

De Vries, A. (2006c). Ranking dairy cows for future profitability and culling decisions. In *Proceedings 3rd Florida & Georgia Dairy Road Show*, pages 92–109.

De Vries, A. (2006d). The dairyVIP program to evaluate the consequences of changes in herd management and prices on dairy. *Department of Animal Sciences, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date September 1, 2006. Visit the EDIS Web Site at http://edis.ifa*, (2001):1–12.

De Vries, A. (2007a). Economic value of a marginal increase in pregnancy rate in dairy cattle. *Journal of Dairy Science*, 90(Suppl.1):423.

De Vries, A. (2007b). The Economic Value of Reproduction in Dairy Cattle. In *Western Dairy Management Conference, Pre-conference Seminar Improving Your Reproductive Odds, Reno, NV. March 6, 2007*.

De Vries, A. (2008). Ranking cows for future profitability: optimizing cow management through reproductive and culling decisions. In *The 2008 Pfizer Dairy Wellness Plan Summit (Eastern US meeting), Weston, FL, March 28-29*.

De Vries, A. (2009a). Good dairy management decisions with changing milk prices. In *Dia Internacional del Ganado Lechero (DIGAL)*, pages 1–15.

De Vries, A. (2009b). Ranking cows for culling decisions. In *Southeast Dairy Herd Management Conference, November 11& 12, 2009, Georgia Farm Bureau Building, Macon, GA*, pages 1–10.

De Vries, A. and Conlin, B. J. (2003). Design and performance of statistical process control charts applied to estrous detection efficiency. *Journal of Dairy Science*, 86(6):1970–84.

De Vries, A. and Galligan, D. T. (2009). Economics of timed AI programs. In *Proceedings of the Dairy Cattle Reproduction Council Conference, November 12-13, Minneapolis, MN and November 19-20, Boise, ID.*, pages 71–81.

Delorenzo, M. and Thomas, C. (1995). Economic decision support systems for dairies. In *2 nd Western Large Herd Dairy Mnagement Conference, Las Vegas*, pages 1–12.

Dentine, M. R. and McDaniel, B. (1987). Comparison of culling rates , reasons for disposal , and yields for registered and grade Holstein cattle. *Journal of Dairy Science*, (19):2616–2622.

DHA (2007). Dairy Herd Analysis. *Pennsylvania and Northeast Statistics*, pages 1–8.

DHA (2008). Dairy Herd Analysis. *Pennsylvania and Northeast Statistics*, pages 1–10.

DHA (2010). Dairy Herd Analysis. *Pennsylvania and Northeast Statistics*, pages 1–8.

Dhuyvetter, K. (2011). Factors impacting dairy profitability. *AG Manager. Info, Department of Agricultural Economics, Kansas State University*, pages 1–18.

Dhuyvetter, K. and Langemeier, M. (2010). Differences between high , medium , and low profi t cow-calf producers : An analysis of 2004-2008 Kansas farm management association cow-calf enterprise. *AG Manager. Info, Department of Agricultural Economics, Kansas State University*, (June 2009):1–18.

Dhuyvetter, K. and Schulte, K. (2010). Factors impacting dairy profitability : An analysis of Kansas farm management association dairy enterprise data. *AG Manager. Info, Department of Agricultural Economics, Kansas State University*, pages 1–16.

Dhuyvetter, K. C., Kastens, T. L., Overton, M. W., and Smith, J. F. (2007). Cow culling decisions: costs or economic opportunity? In *Western Dairy Management Conference Reno, NV March 7-9*, pages 1–17.

Dhuyvetter, K. C. and Smith, J. F. (2005). Business analysis: Which financial tools should I use? In *Proceedings of the 7th Western Dairy Management Conference, March 9-11, 2005, Reno, NV*, pages 107–128.

Dijkhuizen, a. a., Stelwagen, J., and Renkema, J. A. (1986). A stochastic model for the simulation of management decision in dairy herds, with special reference to production, reproduction, culling and income. *Preventive Veterinary Medicine*, 4:273–289.

Doehring, T. A. (2001). Analyzing the Efficiency of Your Operation. *Ag Education & Consulting. LLC (AEC)*, (June):1–5.

Dürr, J. W., Monardes, H. G., Cue, R. I., and Philpot, J. C. (1997). Culling in Quebec Holstein herds . 2 . Study of phenotypic trends in reasons for disposal. *Canadian Journal of Animal Science*, pages 601–608.

Eicker, S. and Fetrow, J. (2003). New tools for deciding when to replace used dairy cows. *Proceedings From 2003 Kentucky Dairy Conference New*, pages 33–46.

FAO (2005). Livestock Sector Brief Iran. *http://faostat.external.fao.org/default.jsp*, (December):1–18.

FAO (2009). Smallholder Dairy Development: Lessons learned in Asia. *Bangkok*, pages 1–187.

FAO (2011). FAO: Food and Agricultural Commodities Statistic. *http://faostat.fao.org/site/339/default.aspx*, page 4.

Farzaneh, M. (1994). Geography and History of Iran. *Nashre sepehr*, pages 1–451.

Ferguson, J. D., Beede, D. K., Shaver, R. D., Polan, C. E., Huber, J. T., and Chandler, P. T. (2000). A method to analyze production responses in dairy herds. *Journal of Dairy Science*, 83(7):1530–42.

Fetrow, J., Nordlund, K. V., and Norman, H. D. (2006). Invited review : culling : nomenclature , definitions , and recommendations. *Journal of Dairy Science*, pages 1896–1905.

Fischer, D. (2000). Methods for managing replacement heifer reproduction. *Dairy Cattle Reproduction Council (DCRC)*, pages 1–3.

Fricke, P. (2000). Factors influencing pregnancy rate of lactating dairy cows. *Extension Specialist in Dairy Reproduction, Dairy Science Dept., UW-Madison*, (Table 2):2–4.

Fricke, P., Stewart, S., Rapnicki, P., Eicker, S., and Overton, M. (2008). Pregnant vs. open : Getting cows pregnant and the money it makes. *University of Wisconsin-Extension*, pages 1–22.

Fricke, P. M. (2003). Monitoring reproduction from the starting gate. In *Proceedings of the 6th Western Dairy Management Conference , March 12-14, 2003*, number 608, pages 77–87.

Galligan, D. T., Ramberg, C., Curtis, C., Ferguson, J., and Fetrow, J. (1991). Application of portfolio theory in decision tree analysis. *Journal of Dairy Science*, 74(7):2138–44.

Global Finance (2012). Iran Country Report 2012. *http://www.gfmag.com/gdp-data-country-reports/253-iran-gdp-country-report.html*, (February):1–3.

Greer, J. E., Falk, S., Greer, K. J., and Bentham, M. J. (1994). Explaining and justifying recommendations in an agriculture decision support system. *Computers and Electronics in Agriculture*, 11(2-3):195–214.

Groenendaal, H. and Galligan, D. T. (2005). Making informed culling decisions how to determine optimal replacement and breeding. *Advances in Dairy Technology*, 17:333–344.

Groenendaal, H., Galligan, D. T., and Mulder, H. A. (2004). An economic spreadsheet model to determine optimal breeding and replacement decisions for dairy cattle. *Journal of Dairy Science*, 87:2146–2157.

Groover, G. E. (2001). *Financial Performance of Pasture-Based Dairies*. PhD thesis.

Hadley, G. L., Harsh, S. B., and Wolf, C. a. (2002). Managerial and financial implications of major dairy farm expansions in Michigan and Wisconsin. *Journal of Dairy Science*, 85(8):2053–64.

Hadley, G. L., Wolf, C. A., and Harsh, S. B. (2006). Dairy cattle culling patterns , explanations , and implications. *Journal of Dairy Science*, (1989):2286–2296.

Hanson, G. D., Cunningham, L. C., Morehart, M. J., and Parsons, R. L. (1998). Profitability of moderate intensive grazing of dairy cows in the northeast. *Journal of Dairy Science*, 81(13):821–829.

Heravi Moussavi, A. (2008). Days in Milk at Culling in Holstein Dairy Cows. *Journal of Animal and Veterinary Advances*, 1:89–93.

Hilty, B. J. (2005). Managing your dairy business with busines$ense. In *Kentucky Dairy Conference*, pages 19–24.

Hilty, B. J., Hyde, J., and Tozer, P. (2008). *Analyzing Your Dairy Business*.

Hogeveen, H. (2005). Mastitis is an economic problem. In *Proceedings of the British Mastitis Conference, Stoneleigh,The Dairy Group*, pages 1–13.

Hogeveen, H., Varner, M. A., Bree, D. C., Dill, D. E., Noordhuizen-Stassen, E. N., and Brand, A. (1994). Knowledge Representation Methods for Dairy Decision Support Systems. *Journal of Dairy Science*, 77(62):3704–3715.

Hondo Group (2009). Cutting costs is primary focus , but improving efficiency , ROI also important. *Dairy Business*, (February):1–4.

Ilias, S. (2010). Iran s Economic Conditions. *CRS Report for Congress Prepared for Members and Committees of Congress Congressional*, pages 1–41.

Investopedia (2012). Definition of ' Return On Investment - ROI '.

Jones, B. L. (2004). Profitability of calving intervals. *University of Wisconsin-Madison Extension*, (April):1–6.

Juarez, S. T., Robinson, P. H., DePeters, E. J., and Price, E. O. (2003). Impact of lameness on behavior and productivity of lactating Holstein cow. *Animal Behaviour Science*, 23(1):1–14.

Juozaitiene, V., Juozaitis, A., and Micikeviciene, R. (2006). Relationship between somatic cell count and milk production or morphological traits of udder in Black-and-White cows. *Turkish Journal of Veterinary and Animal Sciences*, 30:47–51.

Kalantari, A. S., Moradi, M., Sanders, a. H., De Vries, A., and Mehrabani-Yeganeh, H. (2010). Determining the optimum replacement policy for Holstein dairy herds in Iran. *Journal of Dairy Science*, 93(5):2262–70.

Kamalzadeh, A., Rajabbaigy, M., and Kiasat, A. (2008). Livestock production systems and trends in livestock industry in Iran. *Journal of Agriculture and Social Sciences*, pages 183–188.

Karanikolas, T., Ahmed R. Desouky, C. O., Dyomina, L., Vicki Kovacs, C., Rosemary McGuire, C., Gallant, L., Turbide, J., and Richer, F. (2008). *Advanced Financial Accounting Topics Filling the GAAP to IFRS : Teaching Supplements for Canada's Accounting Academics*.

Karszes, J. (1997). Culling rates and profit is there a management issue ? *Department of Agricultural, Resource, and Managerial Economics Cornell University*, pages 1–6.

Karszes, J., Knoblauch, W. A., and Linda D. Putnam (2009). New York Large Herd Farms, 300 Cows or Larger 2008. Technical Report May.

Karszes, J., Knoblauch, W. A., and Putnam, L. D. (2010). New York Large Herd Farms, 300 Cows or Larger 2009. Technical Report May.

Kettering, C. (2002). Agribusiness Planning. *The Pennsylvania State University*, pages 1–12.

Knoblauch, W. A., Conneman, G. J., Putnam, L. D., Buxton, S., and Overton, R. (2010). Hudson and Central New York Region 2009. Technical Report August.

Kramer, E., Cavero, D., Stamer, E., and Krieter, J. (2009). Mastitis and lameness detection in dairy cows by application of fuzzy logic. *Livestock Science*, 125(1):92–96.

Lehenbauer, T. W. and Oltjen, J. W. (1998). Dairy cow culling strategies : making economical culling decisions. *Journal of Dairy Science*, 81:264–271.

Lof, E., Gustafsson, H., and Emanuelson, U. (2007). Associations between herd characteristics and reproductive efficiency in dairy herds. *Journal of Dairy Science*, 90:4897–4907.

Lukas, J. M. (2008). *Statitical Process Control in Dairy Management*. PhD thesis.

Mather, P., Good, M., and More, S. J. (2006). Trends in cow numbers and culling rate in the Irish cattle population , 2003 to 2006. *Irish Veterinary Journal*, 61(7):455–463.

McDaniel, B. (1993). When is AI profitable. In *Western Large Herd Mnagement Conference Las Vegas, Nevada*, pages 80–86.

McGrann, J. (2010). How Young Farm Managers Achieve Success. In *The Free State Agricultures Young Farmer Conference*, page 22.

McGrann, J. (2011). Replacement heifers costs and return investment calculation decision aids. *Texas A&M University*, pages 1–7.

Michael, N. (2002). Pregnancies : A profitability driver on a dairy. *Breeders Journal*, pages 2–5.

Mkhabela, T., Piesse, J., Thirtle, C., and Vink, N. (2010). Modelling efficiency with farm-produced inputs : dairying in KwaZulu-Natal, South Africa. *Agrekon*, 49(1):102–121.

Mohammadi, G. R. and Sedighi, A. (2009). Reasons for culling of Holstein dairy cows in Neishaboor area in northeastern Iran. *Iranian Journal of Veterinary Research Shiraz University*, 10(3):1–5.

Moran, J. (2009). Business Management for Tropical Dairy Farmers. *Business Management for Tropical Dairy Farmers*, pages 1–278.

Nienartowicz-zdrojewska, A. and Dymarski, I. (2009). Culling reasons as related to lifetime dairy performance in Polish Friesian (Black-and-White) cows on Pawowice farm in the years 1909-2006. *Animal Science Papers and Reports*, 27(3):173–180.

Northwest Farm Credit (2008). Understanding Key Financial Ratios and Benchmarks. *Northwest Farm Credit Services Business Tools*, pages 1–12.

NRC (2001). *Nutrient Requirements of Dairy Cattle Seventh Revised Edition , 2001*.

Nuthall, P. L. (2011). *Farm Business Management Analysis of Farming Systems*.

O'Connor, M. L. (1993). Heat detection and timing of insemination for cattle. *The Pennsylvania State University, R3.5M499.ps*, page 19.

Olynk, N. J. (2008). *Economic Analyses of Reproduction Management Strategies and Technologies on U.S. Dairy farms*. PhD thesis.

Oseni, S., Misztal, I., Tsuruta, S., and Rekaya, R. (2003). Seasonality of days open in US Holsteins. *Journal of Dairy Science*, 86(11):3718–25.

Overton, M. W. (2005). *Incentives for Increasing Pregnancy Rate*.

Paul, A. K., Alam, M. G. S., and Shamsuddin, M. (2011). Factors that limit first service pregnancy rate in cows at char management of Bangladesh. *Livestock Research for Rural Development*, 23(3):11.

Pietersma, D., Lacroix, R., Lefebvre, D., Block, E., and Wade, K. (2001). A case-acquisition and Decision-Support System for the analysis of Group-Average lactation curves. *Journal of Dairy Science*, 84(3):730–739.

Pinedo, P. J. and De Vries, A. (2010). Effect of days to conception in the previous lactation on the risk of death and live culling around calving. *Journal of Dairy Science*, 93(3):968–77.

Pinedo, P. J., De Vries, A., and Webb, D. W. (2010). Dynamics of culling risk with disposal codes reported by dairy herd improvement dairy herds. *Journal of Dairy Science*, 93(5):2250–61.

Pla, L. M. (2001). *A Markov Sow Herd Model for on-Farm Decision Support*. PhD thesis.

Poso, J. and Mantysaari, E. A. (1996). Relationships between clinical mastitis , somatic cell score , and production for the first three lactations of Finnish Ayrshire. *Journal of Dairy Science*, 79:1284–1291.

PourKazemi, M. H. and Eftekharzadeh, S. (2011). Choosing Development Path According to Priority Power: Determination of key sector for Iran economy. *International Journal of Business and Development Studies*, 3(1):59–72.

Robinson, P. H. and Juarez, S. T. (2001). Locomotion scoring your cows : Use and interpretation what is a locomotion score ? *Department of Animal Science University of California*, pages 49–58.

Rogers, G., Van Arendonk, J., and McDaniel, B. (1988). Influence of involuntary culling on optimum culling rates and annualized net revenue. *Journal of Dairy Science*, 71(12):3463–3469.

Ruegg, P. L. (2001). Milk secretion and quality standards. *University of Wisconsin, Madison, USA*, pages 1–9.

Sadeghi-Sefidmazgi, A., Moradi-Shahrbabak, M., Nejati-Javaremi, A., Miraei-Ashtiani, S. R., and Amer, P. R. (2011). Estimation of economic values and financial losses associated with clinical mastitis and somatic cell score in Holstein dairy cattle. *International Journal of Animal Bioscience*, 5(1):33–42.

Sadeghi-Sefidmazgi, A., Moradi-Shahrbabak, M., Nejati-Javaremi, A., Miraei-Ashtiani, S. R., and Amer, P. R. (2012). Breeding objectives for Holstein dairy cattle in Iran. *Journal of Dairy Science*, 95(6):3406–18.

Salfer, J. (2002). Improving profit through decreased culling. In *Proceedings Four- State Professional Dairy Management Seminar, Dubuque, IA, June 19-20*, pages 25–34.

Salfer, J. and Schwartau, C. (2004). Using culling / replacement strategy to improve profit. In *Proceedings of Minnesota Dairy Days-2004*, pages 1–17.

Sanders, A. H. and De vries, A. (2008). Comparison of pregnancy diagnosis strategies by stochastic simulation. *Journal of Animal Science 86 (E-Suppl. 2) / Journal of Dairy Science 91 (E-Suppl. 1)*, page 257.

Schmisseur, E. and Gramroth, M. J. (1993). DXMAS: An expert system program providing management advice to dairy operators. *Journal of Dairy Science*, 76:2039–2049.

Shoemaker, D., Eastridge, M., Breece, D., Woodruff, J., Rader, D., and Marrison, D. (2008). *15 Measures of Dairy Farm Competitiveness*.

Sholder, M. (2010). Measuring Profitability on Your Dairy Farm. *http://ezinearticles.com/?Measuring-Profitability-on-Your-Dairy-Farm&id=4488439*, page 2.

Short, S. D. (2000). *Structure, Management, and Performance Characteristics of Specialized Dairy Farm Businesses in the United States*. Number 720.

Smith, J. W., Ely, L. O., and Chapa, A. M. (2000). Effect of region, herd size, and milk production on reasons cows leave the herd. *Journal of Dairy Science*, 83:2980–2987.

Smith, J. W., Gilson, W. D., Ely, L. O., and Graves, W. M. (2009). Dairy Reproduction Benchmarks. Technical report.

Smith, T. R. (1989). The potential application of expert systems in dairy extension education. *Journal of Dairy Science*, 72(10):2760–2766.

Socha, M. T., Defrain, J. M., and Tomlinson, D. J. (2009). Are the right cows leaving the herd ? *Zinpro Corporation*, pages 1–14.

Socha, M. T., Tomlinson, D. J., Ward, T. L., and Coporation, Z. (2005). Using locomotion scoring to put together a program to reduce lameness on the dairy. *Zinpro Corporation*, pages 1–9.

Somervill, B. A. (2012). Iran. *Scholastic Library Pub*, page 144.

Sorge, U. S., Kelton, D. F., Lissemore, K. D., Sears, W., and Fetrow, J. (2007). Evaluation of the dairy comp 305 module cow value in two Ontario dairy herds. *Journal of Dairy Science*, pages 5784–5797.

Spahr, S., Jones, L., and Dill, D. (1988). Expert SystemsTheir Use in Dairy Herd Management. *Journal of Dairy Science*, 71(3):879–885.

Spahr, S. L. (1993). New technologies and decision making in high producing herds. *Journal of Dairy Science*, 76(10):3269–77.

Stads, G.-J., Roozitalab, M. H., Beintema, N. M., and Aghajani, M. (2008). Agricultural Research in Iran. Technical Report October.

Stahl, B. (2011). Heat detection skills : A critical factor in the reproduction equation.

Statistic Centre of Iran (2009). Sectors of Iranian Economy. pages 1–76.

Strasser, M. (1997). *The Development of a Fuzzy Decision-Support System for Dairy Cattle Culling Decisions*. PhD thesis.

The Farm Financial Standards Council (FFSC) (1997). *Financial Guidelines for Agriculture Producers*.

The U S Department of Agriculture (2010). *Proceedings of the 5th Natinonal Small Farm Conference*.

Tozer, P. and Ford, S. (2000). The economics of extended calving internals software and hardware. *Pennsylvania State University*, pages 1–11.

Tozer, P. R. and Heinrichs, A. J. (2001). What affects the costs of raising replacement dairy heifers : A multiple-component analysis. *Journal of Dairy Science*, pages 1836–1844.

Tronstad, R. and Gum, R. (1994). Adapted Culling Management with CART. *Journal of Agricultural Economics*, 76(2):237–249.

University of Pennsylvania (2000). *Pennsylvania Dairy Farm Business Analysis*.

Weigel, K. A., Palmer, R. W., and Caraviello, D. Z. (2003). Investigation of factors affecting voluntary and involuntary culling in expanding dairy herds in Wisconsin using survival analysis. *Journal of Dairy Science*, 86:1482–1486.

Wiebe, I. (2009). Analyzing a Farm Business. *Farm Plan, Manitoba Agriculture and Food*, pages 1–22.

Wiggans, G. R. and Jr, R. C. G. (2005). Accounting for pregnancy diagnosis in predicting days open. *Journal of Dairy Science*, 17042:1873–1877.

Wiltbank, M. C., Weigel, K. A., and Caraviello, D. Z. (2007). Recent studies on nutritional factors affecting reproductive efficiency in U . S . dairy herds . In *Western Dairy Management Conference, Reno NV, 2007*, number 2000, pages 61–72.

Wittenberg, E. and Wolf, C. (2009). 2008 Michigan Dairy Farm Businuess Analysis Summary. *Department of Agricultural, Food, and Resource Economics MICHIGAN STATE UNIVERSITY East Lansing, Michigan*, pages 1–65.

Wittenberg, E. and Wolf, C. (2010). 2009 Michigan Dairy Farm Business Analysis Summary. *Department of Agricultural, Food, and Resource Economics MICHIGAN STATE UNIVERSITY East Lansing, Michigan*, pages 1–80.

Wittenberg, E. and Wolf, C. (2011). 2010 Michigan Dairy Farm Business Analysis Summary. *Department of Agricultural, Food, and Resource Economics MICHIGAN STATE UNIVERSITY East Lansing, Michigan*, pages 1–78.

Zinpro (2005). Assessing Cattle Lameness. *Zinpro Corporation*, pages 1–5.