APPLYING THE COOPERATIVE MODEL TO VETERINARY MEDICINE: A CASE STUDY OF A SHARED IMAGING CENTER

By

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APPLYING THE COOPERATIVE MODEL TO VETERINARY MEDICINE: A CASE STUDY OF A SHARED IMAGING CENTER

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Abstract: Consolidation in the veterinary industry, combined with rising levels of veterinary student debt and stagnant incomes, is making it more and more difficult for small and independent veterinarians to remain competitive. These veterinarians are increasingly in need of business strategies to help them reduce costs and improve profitability. The cooperative model has a rich history of enabling relatively small market players to collaborate and gain efficiencies or reduce costs, but little research has been conducted with regard to applying the cooperative model to assist veterinarians. The primary objective of this research was to educate veterinarians regarding collaborative equipment cost-sharing efforts, which could increase the profitability of their respective businesses. A user-friendly, downloadable, spreadsheet template was created to analyze the feasibility of a veterinary imaging center, both as a cooperative and as an investment for a single veterinary practice. Construction and equipment costs, as well as imaging service charges, costs, and volumes were estimated in order to create a hypothetical case study comparing the returns of an individually-owned veterinary imaging center to a four-veterinarian imaging cooperative. If demand is supportive of the additional imaging service volumes needed to sustain four veterinarians, a veterinary imaging cooperative appears to be a more profitable investment opportunity compared to an imaging center owned by an individual veterinarian. Providing substantially more services with only a slightly larger investment in facilities in equipment makes the cooperative imaging center more profitable. The spreadsheet template created for this study can be modified to fit a variety of veterinary issues, or can even be applied beyond the scope of the veterinary industry.

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CHAPTER I

INTRODUCTION

Problem Statement

Recent data from the American Veterinary Medical Association (AVMA) show the financial condition for veterinarians, especially recent graduates, significantly worsened over the past decade. Since 2007, real veterinary student debt has increased at a rate of 3.4% per year, while real starting salaries for full-time veterinarians remained flat during the period, and actually decreased from 2010 to 2014 (AVMA 2015). As veterinary debt continues to increase at a higher rate than veterinary income, veterinarians are increasingly in need of cost-reduction strategies. Moreover, these financial struggles are making it challenging for small and independent veterinarians to remain competitive, causing the industry to consolidate into fewer, large firms. Recent veterinary press has shown the sector to be ripe with consolidation, making it more and more difficult for younger veterinarians with aspirations of practice ownership to find independent practices with similar values (Adler et al. 2014).

Veterinary consolidation culminated in January 2017 when Mars Inc. acquired VCA Inc. for $7.7 billion (Heath 2017). Mars, perhaps best known for its candy and gum brands, also owns Banfield, a chain of over 1,000 veterinary clinics and hospitals. VCA provides pet healthcare services through a network of clinical laboratories and over 750 free-standing animal hospitals. In

addition, VCA sells diagnostic imaging equipment and other technology-related products and services to veterinarians. The acquisition of VCA will help the pet business sector to become Mars's largest, surpassing its candy and gum segments (Heath 2017).

Dicks (2017) argues consolidation in the veterinary industry is occurring because some firms have discovered how to get more out of veterinary practices than what had previously been achieved. Because typical veterinary businesses focus on maximizing profit per client rather than maximizing the number of clients and meeting all the healthcare needs of each animal, an opportunity has been presented to consolidators to capture unrealized gains by lowering costs through economies of size (Dicks 2017).

Dicks (2017) claims consolidation will begin to slow if existing firms can develop business models to attract more clients and offer more goods and services at a lower cost. This research will focus on developing a strategy for small and independent veterinarians to cost-effectively offer a wider variety of services in order to mitigate industry consolidation efforts. The cooperative model has a rich history of enabling relatively small market players to collaborate and gain efficiencies or reduce costs, raising the question: could the cooperative model be implemented in the veterinary industry?

The U.S. cooperative business model can trace its roots to the second half of the 18th century, when consumer cooperatives were formed during the English Industrial Revolution to obtain goods and services for members faced with hostile working conditions and low wages (Bakken and Scharrs 1937). Over the years, many industries have utilized the cooperative structure when faced with adverse business conditions in order to remain competitive by pooling resources with similar entities. Early examples of cooperative corporations include loan and credit organizations, farm marketing and supply cooperatives, and fire insurance companies (UWCC 2016).

The agricultural and medical industries are examples of beneficiaries of both formal and informal cooperative agreements. While the word "informal" may imply the total absence of legal

structure, it is used here to distinguish between entities legally structured as cooperatives and those structured under different business forms, such as corporations, partnerships, and limited liability companies (LLCs). Formal cooperative arrangements are more common in the agricultural sector because of existing legislation to support and protect agricultural cooperatives such as the Capper-Volstead Act (1922), Smith-Lever Act (1914) and Cooperative Marketing Act (1926). This legislation was enacted to protect agricultural cooperatives from strict antitrust laws passed in the U.S. in the early 1900s (UWCC 2016).

In contrast, informal cooperative agreements are more common in the human healthcare industry (Cohealo 2016; SMS 2016). Examples of collaboration between medical entities include sharing equipment, laundry services, administrative services, and combining demand to receive increased purchasing power for medicine and supplies (Bhuyan 1996; Crooks, Spatz, and Warman 1997). Related to agriculture, informal cooperative agreements have been utilized for producers to share the cost of owning and operating costly planting and harvesting equipment (Kenkel and Long 2007).

Because of the structural similarities between the human medical and veterinary sectors, cooperative strategies that benefitted the medical industries in recent years could potentially aid the veterinary industry as well. This research will help determine the prospective cost savings for multiple veterinarians to collaborate by creating a shared-equipment facility. A shared facility could be designed to house costly, possibly underutilized, imaging and diagnostic equipment such as MRI, X-ray, and dental imaging equipment. This facility would allow veterinarians to share the financial burden of owning and operating this equipment with other veterinarians, while still being able to provide a wide range of veterinary services.

Objectives

The primary objective of this research is to educate veterinarians regarding collaborative equipment cost-sharing efforts, which could increase the profitability of their respective entities. Specific objectives include:

1. Determine potential revenue from veterinary imaging services, operating and overhead costs associated with imaging and diagnostic equipment, as well as the costs to construct a diagnostic imaging facility,
2. Determine if the cooperative model can be applied to the veterinary industry as a way for small and independent practice veterinarians to compete with larger entities,
3. Develop a user-friendly template that allows veterinarians to assess the feasibility of forming a shared imaging cooperative, and
4. Compare the financial impacts of organizing a veterinary imaging clinic under both the cooperative structure and individual ownership.

CHAPTER II

REVIEW OF LITERATURE

Overview of the Cooperative Business Structure

Cooperative Purpose and Impact

Before making a case for why and how the cooperative business structure can be utilized by veterinarians in a rapidly-changing veterinary medicine industry, an overview of the cooperative structure is beneficial to understand the benefits a shared services cooperative can offer veterinarians. A cooperative is a business controlled by its members, and operated for the benefit of its members, rather than with a goal of profit maximization for outside investors (UWCC 2016). Cooperatives are controlled democratically, meaning members receive voting rights as a benefit of their membership. Any net earnings left over after paying expenses are distributed to members on the basis of proportional use, or patronage, rather than on the basis of their proportional investment (UWCC 2016).

Barton (1989) described three perspectives from which cooperatives can be viewed. The first perspective is obtained by examining the benefits received by cooperative users and the responsibilities these users have. Users often desire to either purchase products or services from a cooperative as economically as possible or to use the cooperative to market their finished products for the greatest return (Barton 1989). Users are responsible for both ownership and

control of the cooperative. The second perspective is the view of the different roles users have in their relationships with the cooperative. Users fill the roles of customer, patron, owner, and member (Barton 1989). The third perspective from which cooperatives can be viewed is through the type of business transactions between the cooperative and its users. The four main types of business transactions outlined by Barton (1989) include (1) buying and selling of products and services, (2) distribution of net income as patronage refunds, (3) maintenance of the owner's equity account through equity investment and redemption, and (4) exercise of member control through voting.

Deller eat al. (2009) attempted to quantify the impact of cooperatives on the U.S. economy. A total of 29,284 cooperatives were identified and 16,151 were surveyed by Deller et al. (2009) through conducting a census of cooperatives. By extrapolating from their sample to the entire population, Deller et al. (2009) estimated that cooperatives in the U.S. account for over two million jobs and $650 billion in revenue, the majority of which ($394 billion) can be attributed to the financial services sector, including credit unions, the Farm Credit System (FCS), mutual insurers and a few, large financial institutions that provide loans to cooperative businesses. Figure 1 below outlines the description of cooperatives in each of the four sectors in the U.S. (Deller et al. 2009).

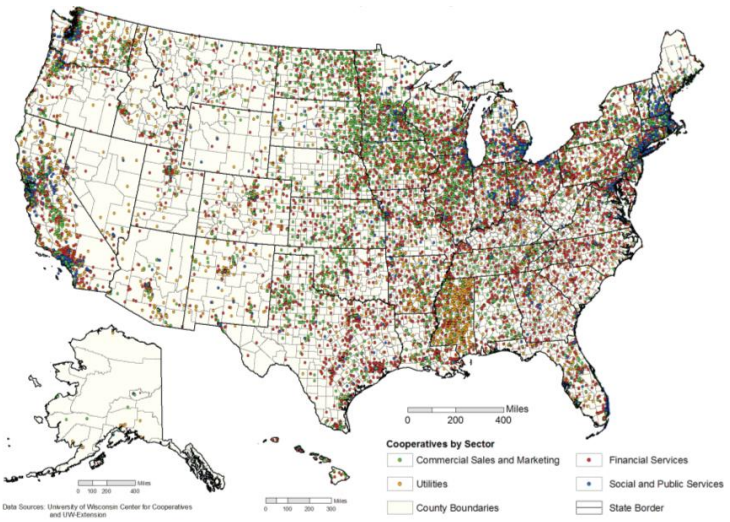

Figure 2.1: Distribution of Cooperatives in the U.S. by Sector (Deller et al. 2009)

Shared-Service Cooperatives and Their Justification

Beyond the concept of individuals forming a cooperative, it is also common for businesses to create a joint venture in the form of a cooperative, known as a shared-services cooperative. According to Crooks, Spatz, and Warman (1995), a shared-services cooperative is defined as a group of private businesses or public entities that form a cooperative to provide services to either enhance or increase the competitiveness of their respective operations. Primary goals of a shared-services cooperative often include capturing savings through lower administrative costs, quantity purchasing discounts, sharing fixed costs, and assured levels of business with vendors and suppliers (Crooks, Spatz, and Warman 1995).

Anderson et al. (1995) argues the majority of cooperative approaches evolve out of attempts by individuals or firms to address two major economic issues: market problems or a lack of economies of size. Bhuyan (1996) outlines three unique attributes of shared-services cooperatives: (1) shared-services cooperatives, in general do not deal with agricultural products or services, (2) members are typically independent private businesses or public entities engaged in similar forms of business, and (3) these cooperatives acquire and provide members with discounted supplies and services rather than producing new products. Crooks, Spatz, and Warman (1997) outlined an example of a rural healthcare cooperative designed to hire and pay a full-time doctor to be shared among member hospitals who, in turn, would reimburse the cooperative for the period of service they use. This type of service is particularly appealing to smaller healthcare facilities only needing a doctor's service on a part-time basis, and could be of similar value for veterinary clinics in rural, sparsely-populated areas.

While agricultural cooperatives have traditionally been popular in the U.S., Bhuyan and Olson (1998) explored the possibilities of areas where the cooperative business model could be used in non-agricultural industries in North Dakota to support economic development. To examine the potential to offer non-agricultural goods and services in rural North Dakota using the cooperative approach, Bhuyan and Olson (1998) organized two separate focus groups in April

1997 in LaMoure County and Sioux County. Focus groups were facilitated with three primary objectives: (1) to identify major problems residents have in obtaining goods and services in the study area, (2) to examine whether there was potential for the cooperative business model to provide goods and services in the study area, and (3) to examine whether follow-up action was desired by study participants (Bhuyan and Olson 1998). In the LaMoure County focus group, participants identified competition from national retail stores like Walmart and K-Mart as a major problem for area merchants. Interestingly, participants in the LaMoure County focus group also cited the absence of a resident veterinarian as an important problem for residents, leading to a lack of regular veterinary care for their pets and livestock (Bhuyan and Olson 1998).

Sioux County, North Dakota differs from LaMoure County because it is almost entirely comprised of land designated as a Native American Reservation. Bhuyan and Olson (1998) found most of the economic issues raised by participants in the Sioux County focus group were related to conflicts between tribal laws and non-Native American businesses. All in all, Bhuyan and Olson (1998) discovered residents from both counties in the study were interested in learning how the cooperative business model could be applied to non-agricultural industries, and seemed motivated to discover if the model could help solve issues within their respective communities. However, to make the model work, Bhuyan and Olson (1998) noted it was critical for residents to realize the type of cooperation needed to be successful requires a concentration of effort coming from those who will benefit from such cooperation, as opposed to an outside entity.

Building upon previous research, Bhuyan and Leistritz (2001) set out to identify factors that determine the success of a cooperative business in a non-agricultural industry. To test which variables have the most impact, 1,000 non-agricultural cooperatives were surveyed and a logit model was used to measure the likelihood of a cooperative succeeding. The most common reason cooperatives were formed was in response to market failure (Bhuyan and Leistritz 2001). Overall, Bhuyan and Leistritz (2001) found the most successful non-agricultural cooperatives to be those

that could control their operating costs and market their products or services as unique or essential compared to those of competitors.

Examples from the Healthcare Industry: Hospital-Physician Relationships

Horspool (2013) claims companion animals are living longer, and their care often mirrors trends in human healthcare. Diagnosis and disease monitoring in veterinary medicine through imaging techniques like ultrasonography, computed tomography (CT) and magnetic resonance imaging (MRI) are becoming increasingly popular, especially for companion animals (Horspool 2013). Therefore, studies and trends related to human healthcare would likely translate to the veterinary sector.

In writing about potential applications for shared-services cooperatives, Bhuyan (1996) argues hospitals and healthcare centers in both non-metro and metro areas may consider forming cooperative alliances to share the costs of expensive equipment, form rural emergency services, purchase supplies, train doctors and nurses, and purchase healthcare insurance for members' employees. Additionally, the healthcare industry has already used cooperatives to launder the linens of member hospitals (Bhuyan 1996). These medical applications would likely be most easily adapted to the veterinary medical industry.

Specifically related to a shared imaging cooperative, which is the focus of this research, Goldstein (2013) notes that equipment sharing could allow members of a physician cooperative to provide a wider array of services at a lower cost. By acting as one unit, cooperatives are able to take advantage of economies of scale, market clout, bargaining power, and efficiency. Specialty services like radiology could be offered to other cooperative members, especially benefitting primary care specialists, who otherwise would not be able to provide services like radiology and laboratory services to patients (Goldstein 2013). In addition to allowing physicians to offer a wider array of services to patients, joint ownership would lower associated risk and costs by spreading them among all member physicians, rather than one physician being forced to bear them individually (Goldstein 2013).

Goldstein (2013) points out that the purpose of a physician cooperative would not be to generate a profit for itself. Rather, the purpose of a physician cooperative would be to enable its members to be more competitive in the marketplace with larger firms (Goldstein 2013). The consolidation currently taking place in the veterinary sector has been occurring in the healthcare sector for decades. The number of healthcare physicians working in private practices has declined from 57% in 2000 to 39% in 2012, and continues to decline at a rate of 2% annually (Goldstein 2013).

Underused equipment has been cited as a reason for increased costs in the healthcare industry (Horblyuk et al. 2012), which could potentially translate to the veterinary industry as well. To analyze changes in hospital asset inventory and the rising costs associated, Horblyuk et al. (2012) used data collected from 45 hospitals from the GE Healthcare Asset Management Team. Data was collected from 2008 to 2010 and compared with data collected from 1995 to 1997. Horblyuk et al. (2012) found an increase in the number of services offered per patient combined with low utilization rates has created a serious cost issue for many hospitals. Horblyuk et al. (2012) concluded that hospitals generally have about 25% more mobile equipment devices than necessary, and believe a utilization rate of 70-80% is a realistic target. The authors estimate annual service costs for a 200-bed hospital could be reduced by $160,000 if its mobile equipment device inventory was reduced by 25% (Horblyuk et al. 2012).

Equipment and Service Sharing Examples in the Medical Industry

Because of rising equipment costs and low utilization rates, medical facilities are employing creative strategies to remain as competitive as possible. Cohealo was founded in 2011 to bring hospitals together in collaboration through a shared technology platform, analytics, and supporting logistics to make medical equipment available anywhere, anytime (Cohealo 2016). Founders targeted inefficiencies in the health services industry, with firms investing tens of millions of dollars each year on equipment purchases and rentals, while only having an equipment utilization rate of 42% (Cohealo 2016). Cohealo is attempting to create a model

comparable to Uber or Airbnb, providing a platform for hospitals to share equipment. Cohealo is working to bring equipment utilization rates closer to 75-80% by pooling the resources of multiple hospitals. Traditionally, hospitals have obtained equipment through either outright purchase or renting. High rental rates on medical equipment often lead hospitals to purchase equipment, even if managers knew it would be used infrequently (Lorenzetti 2014).

While Cohealo is an investor-oriented firm (IOF), seeking to make a profit for its founders and other investors, the cooperative business form has also been used to allow hospitals to reduce costs through equipment sharing ventures. The Rural Health Alliance was formed in West Central Minnesota by four rural hospitals in 1983. During its existence, the cooperative has provided its members with regional group purchasing, courier service, emergency preparedness coordination, shared radiology equipment, shared technical staffing, nurse staffing pool, telemedicine, and regional data exchange planning (RHA 2016).

Shared Medical Services (SMS) is another example of a company started to help hospitals lower their equipment costs through sharing agreements with other hospitals. Coordinating between multiple hospitals, SMS was formed to allow healthcare facilities to choose the type of imaging and service solutions to meet their needs without the costly investments in equipment and staff required to purchase the equipment outright. SMS has expanded its service offerings in recent decades to keep up with changes in medical technology, especially benefitting small, rural healthcare facilities unable to afford costly equipment like MRI and CT scanners (SMS 2016).

New Seattle Massage, established in 1981, offers a unique cooperative example that differs from those previously described. Rather than focusing on sharing expensive types of equipment to reduce costs, as hospitals do, New Seattle Massage members focus on reducing overhead costs by sharing an operating facility and non-core services. New Seattle Massage is a massage clinic for stress management, injury recovery, and health maintenance. What is unique about New Seattle Massage is the business is structured as a cooperative, with more than 15

Washington State Licensed practitioners. Each massage practitioner is self-employed, and joined the cooperative for the ability to pool resources. When a client receives a massage at New Seattle Massage, the massage practitioner who serviced them directly receives the money paid by the client. The practitioner then turns around and contributes a portion of the price to the cooperative for costs shared with other practitioners such as laundry, receptionists, facility rent and upkeep, administration, and advertising (New Seattle Massage 2016).

Structuring as a cooperative allows practitioners to provide amenities they could not individually afford because of the cost-sharing benefits. These amenities include a steam room, sauna, showers, and the ability to answer client phone calls 84 hours per week. In addition, the cooperative structure frees practitioners from washing laundry, answering phone calls, administrative work, and allows them to practice massage therapy for an increased number of hours per week (New Seattle Massage 2016).

Agricultural Shared-Equipment Cooperatives

While shared-equipment cooperatives and joint ventures are relatively new to medical fields, shared-equipment cooperatives have been used in agricultural industries for decades. During the late 20th century, the significant increase in farm size led to an increase in the size of farm machinery needed for farmers to work more land (Ford and Cropp 2002). Ford and Cropp (2002) outlined five different methods for sharing agricultural machinery utilized in Canada, including (1) piece-by-piece, (2) sharing of complete farm machinery sets, (3) pooled production (4) non-pooled production, and (5) labor sharing. The authors concluded the optimal strategy depends on each farmer's flexibility and willingness to make group decisions (Ford and Cropp 2002).

Heavrin (2002) compiled a series of case studies to analyze how small marketing cooperatives purchase and share a variety of equipment and machinery, as well as resources and facilities. All examples included in this case study focus on increasing profitability for agricultural producers by lowering their individual costs associated with purchasing equipment.

This is accomplished through spreading the cost of purchasing equipment across multiple farmers by sharing equipment and machinery (Heavrin 2002).

The final segment of the case study prepared by Heavrin (2002) analyzes how online platforms like MachineryLink.com have enabled farmers to connect with other farmers to share the burden of purchasing costly equipment, such as combines to harvest their crops. Even though MachineryLink.com is not structured as a cooperative, the same principle of sharing equipment to reduce costs still applies. When it was founded in 2000, MachineryLink provided maintenance, repairs, and delivery for the equipment leased through its website, providing an added benefit to producers. The leasing program allowed farmers to take advantages of different harvesting times for different crops and regions, meaning it is ideal for them to share with other farmers on a different schedule than themselves. In addition to its managed leasing program, MachineryLink offered additional tools to farmers in the form of a searchable database of used equipment, a list of tools and resources for farmers, a farm equipment cost calculator, a listing of related research publications, and a guide to farm auctions (Heavrin, 2002).

MachineryLink currently earns revenue on each transaction by charging equipment users an additional 5% on top of the price they agreed upon with the equipment owner, as well as by withholding 10% of the transaction proceeds from the equipment owner MachineryLink 2016). This means on a $1,000 transaction, MachineryLink would earn $150. The buyer/equipment user would pay $1,050 to use the equipment and the equipment owner would receive $900 from renting out his or her equipment. MachineryLink no longer accepts the responsibility of maintenance, repair, and delivery for equipment, as it is no longer the equipment lessor. Agreements are now made between farmers and MachineryLink simply provides the means for farmers to meet other farmers with whom to share equipment (MachineryLink 2016).

Along the same lines, Kenkel and Long (2007) took the idea of sharing equipment to help farmers lower their costs one step further by combining it with the cooperative business structure. These researchers compared the cooperative structure to other common business structures used

for equipment sharing joint ventures. The simplest form of machinery sharing is an informal agreement where two or more producers trade currently-owned equipment or jointly-purchased equipment without a formal legal structure. The primary issue with an informal agreement is no structure exists to fall back on if a disagreement arises between producers (Kenkel and Long 2007).

A more formal type of agreement used by agricultural producers to share equipment and machinery is a contractual agreement. Under this agreement, a written financial contract outlines the framework for the allocation of investment costs, depreciation, and expenses (Kenkel and Long 2007). The contract may also specify a schedule for usage as well as where the machinery will be housed and how maintenance and repairs will be handled. A common and robust form for equipment and machinery sharing is a limited liability company (LLC). An LLC combines the limited liability features of a corporation with the pass-through taxation benefits of a partnership (Kenkel and Long 2007).

Kenkel and Long (2007) argue a cooperative structure is appropriate for a machinery and equipment sharing joint venture because it relies upon investment and benefits proportional to usage. Ultimately, they concluded the LLC and cooperative business models are viable long-term options for equipment and machinery sharing ventures between agricultural producers. However, some possible advantages a cooperative structure may have over an LLC structure are related to capital accounts, exit and valuation mechanism, and operation of multiple equipment pools and/or labor sharing.

Examples of Veterinary Cooperatives and Equipment/Service Sharing

Likely due, at least in part, to their respective sizes and scopes, the agricultural equipment and human medical industries have provided many more examples of collaborative efforts between practices to share equipment or services than the veterinary medicine industry. However, as the veterinary industry consolidates into fewer, larger firms, practices are being forced to find ways to cut costs in order to remain competitive. Because of the similarities in structure and

nature of services, examples of cooperative ventures in the healthcare industry would likely be most relevant to veterinarians investigating similar ventures. Veterinary clinics often have similar equipment, similar organizational structures, and offer similar services, albeit on a much smaller scale, compared to hospitals and other human healthcare facilities. Some practices are utilizing creative collaborative strategies to pool resources with other veterinary clinics.

One example of a business formed to manage veterinary surgery costs is Mobile Veterinary Specialist (MVS). MVS was established in 2012 to bridge the gap between primary veterinary care clinics and referral veterinary hospitals in the Central Texas region. The MVS business model allows mobile surgeons to provide specialty procedures and services to clients in the comfort of their primary care provider's office. MVS currently serves around 60 veterinary primary care offices in Austin, TX and its suburbs. By having low overhead, mobile surgeons are able to offer their procedures at a lower cost than a specialty hospital to which a client may have to drive a long distance (MVS 2016). While the name "mobile" might imply that the surgeons operate out of a large truck or van, they simply collaborate with primary care veterinarians by using their own surgical equipment in the operating room of the primary care veterinarian's facility. MVS offers clients surgeries the areas of (1) orthopedic surgeries, (2) soft tissue surgeries, and (3) oncologic surgeries (MVS 2016).

While there aren't many examples of veterinarians collaborating to share equipment, purchasing groups have become increasingly popular in recent years. Lau (2013) suggested consolidation in the veterinary industry is the primary driver for the influx of veterinary group purchasing. Purchasing groups allow small and independent practice veterinarians to combine their purchasing power in order to negotiate better deals with vendors. Some purchasing groups also handle warehousing and distribution for their members. While some purchasing groups are privately-owned businesses, others are structured as cooperatives. Table 2.1 details three large veterinary purchasing cooperatives.

Table 2.1: Veterinary Purchasing Group Cooperatives

	Veterinary Hospitals Association (VHA)	Veterinary Products, Inc. (VPI)	The Veterinary Cooperative (TVC)
Headquarters	St. Paul, Minnesota	Kennesaw, Georgia	Evanston, Illinois
Year Established	1984	1994	2012
Region Served	IA, MN, ND, SD, WI	AL, GA, FL, MS, SC, TN	All U.S. States
Number of Members	365	615	260
Membership Fee	$60 per facility and $60 per doctor/year	One-time purchase of 100 shares for $1,200	One-time payment of $2,500
Vendors	50	40	20
Confidentiality Clause	No	No	Yes
Web Address	http://veterinaryha.org/	http://www.vpivets.com/	http://www.theveterinarycooperative.coop/

Guidelines for Setting up a Veterinary Shared-Equipment Facility

Very little literature exists related to constructing a diagnostic or imaging clinic for veterinarians. Klaunberg and Davis (2008) explain the process of constructing an imaging facility for animals, but with a laboratory research emphasis. Because MRI has the most restrictive conditions, is heavily infrastructure-dependent and poses unique occupational safety hazards, an imaging center should be constructed around the MRI suite (Klaunberg and Davis 2008). Klaunberg and Davis (2008) argue that an imaging facility is better shared than utilized by a single entity because the cost of purchasing and setting up one MRI suite would be enough to prohibit a smaller entity from constructing such a facility. Also written with laboratory animals in mind, Weisenberg (2009) offers an overview of construction considerations for designing an MRI facility. Especially in urban areas, it is necessary to be mindful of factors like ground vibrations caused by traffic on nearby roads, railways, and subways (Weisenberg 2009). Weisenberg (2009) proposes an imaging facility design divided into four basic spaces: (1) the animal prep room, (2) the equipment or technical room, (3) the magnet room, and (4) the operational control and observation room.

The University of Minnesota added a veterinary imaging center to the second floor of its existing veterinary hospital in 2007. According to the predesign report, the total construction cost

estimate was placed at $3.7 million for an MRI procedure room and control area, a large animal prep and recovery area, a small animal prep and recovery area, and two additional toilets. The $3.7 million estimate was comprised of $2 million in equipment and $1.7 million for the actual construction. In justifying the need for this facility, the University of Minnesota planned to use the imaging center concept to allow a client's primary care deliverer to have direct access to the imaging center or to be able to refer clients to a specialist at the facility ("Predesign Report for…" 2007).

Before deciding what types of services should be offered at a veterinary imaging center, the relative costs and potential charges for imaging services should be considered. Sistrom and McKay (2004) collected data from Florida hospitals related to costs, charges, and revenues from diagnostic imaging services. Of the four services examined, CT scans were found to have the lowest operating expense but a mean charge of $1,565 (Sistrom and McKay 2004). MRI had the highest charge ($2,048) but also had the highest operating expense. Because of its higher margin, Sistrom and McKay (2004) conclude CT is preferable to MRI from a cost standpoint, but acknowledge that the profit potential for performing either service seems to be substantial. Demand estimates, along with associated costs and potential fees would be needed to know which services would prove most profitable in a veterinary imaging clinic.

The primary focus of Adler and Kuta (2011) was to outline an approach physicians can utilize to pool resources: a shared diagnostics facility to house equipment such as MRI, CT, and PET, as well as the space where diagnostic procedures are performed. Adler and Kuta (2011) conclude a shared facility may be an affordable way for many physician practices to provide necessary and better diagnostic services to patients. For independent or small group physician practices, it could offer the only venue for these practices to compete with the vast resources of larger practices (Adler and Kuta 2011). Similar to physician practices, independent and small practice veterinarians could benefit from this model, allowing them to combat the consolidation that has led to fewer, larger firms in the veterinary medical industry. A shared-equipment

cooperative would allow veterinarians to jointly purchase equipment to perform a wide variety of surgery or imaging services to clients. Because medical equipment is expensive, veterinarians must sell a large number of services using the equipment, over time, to pay back the cost of their investment. In areas with a high concentration of veterinarians, there is greater potential to jointly purchase equipment and create a shared facility for participating veterinarians to have access to equipment when needed.

While the majority of literature related to imaging facilities has focused on designing the facility to work optimally, Junk and Gilk (2007) focus on the costs of various aspects of the facility. MRI equipment is more expensive than suite construction itself, but the cost varies depending on the power of the magnet selected. Three technical spaces are needed for an MRI to operate, including the radio frequency-shielded magnet room, the control room, and a computer room for the gradient cabinets and support electronics. Collectively, these three spaces are estimated to require roughly 1,000 square feet (Junk and Gilk 2007).

Junk and Gilk (2007) estimate the cost to build the three technical spaces required for an MRI center range from $350-$400/sq. ft., depending on whether it is being added to a medical office building or hospital. If the MRI suite is not being added to an existing facility, Junk and Gilk (2007) estimate the cost for support spaces for reception, patient screening, bathrooms, prep areas, and other spaces would range from $150-$200/sq. ft. The authors do specify the numbers provided are U.S. average budgetary numbers and should be modified to fit specific situations based on a list of factors.

Yanci (2006) provides a case study of a 705-bed hospital's decision to invest in an imaging facility and examines the considerations made during the decision-making process. The hospital hired a third-party market research firm to gather information from other healthcare providers regarding their MRI equipment, hours of MRI operation, and how much of a backlog they had. One of the most difficult decisions to be made, according to Yanci (2006), is the selection of equipment. To make equipment selections, the hospital examined in the case study

scheduled vendor presentation meetings and then site visits based on the initial presentations, followed by the development of a Quality Functional Development (QFD) tool to make final selections (Yanci 2006).

In summary, very little research has been conducted related to cooperation in the veterinary industry, let alone specific equipment sharing agreements. Examples from the human healthcare sector help form an idea of what a shared veterinary imaging center could look like. The cooperative model has been utilized by agricultural industries for decades, and cooperative strategies have become increasingly important to human healthcare in recent years. A cooperative business structure, as well as other business structures, should be examined for their use in a shared veterinary imaging center. Based on prior research, the construction of shared veterinary imaging center could be utilized by independent and small practice veterinarians in order to provide a wide range of services while sharing the financial burden of owning and operating costly equipment.

CHAPTER III

CLINIC DESIGN AND ESTIMATION METHODS

A template was developed using a Microsoft Excel workbook to analyze the feasibility of a veterinary imaging center, both as a cooperative and as an investment for a single vet practice. The workbook contains sheets that require users to input information, as well as sheets that use formulas to project the financial impacts of these inputs. The purpose of this feasibility template is to provide veterinarians with a downloadable tool that can be adapted to evaluate unique situations. A veterinarian can choose to use the spreadsheet to estimate the financial impacts of expanding to offer imaging services individually, as a cooperative with other veterinarians, or both to compare the two structures.

Both the cooperative and individual veterinarian portions of the workbook contain sheets for inputs, depreciation and amortization, and a returns summary. Inputs pages contain information related to financing, taxes, utilities, service types and charges, construction and personnel. Depreciation and amortization sheets summarize loan principal and interest payments, as well as depreciation on facilities and equipment. The summary pages have no variable input cells, but simply provide an overview of the returns and cash flow implications of the assumed inputs. Specific to the imaging cooperative, the spreadsheet template also contains a separate members' equity sheet to illustrate how equity flows into and through the cooperative, as well as the effects of different revolving stock periods. The final sheet within the workbook compares the

returns of an individually-owned veterinary imaging center to an imaging cooperative using net present value (NPV), internal rate of return (IRR), return on assets (ROA), return on equity (ROE), and return on investment (ROI). Figure 3.1 outlines the components of the spreadsheet template and illustrates its basic structure.

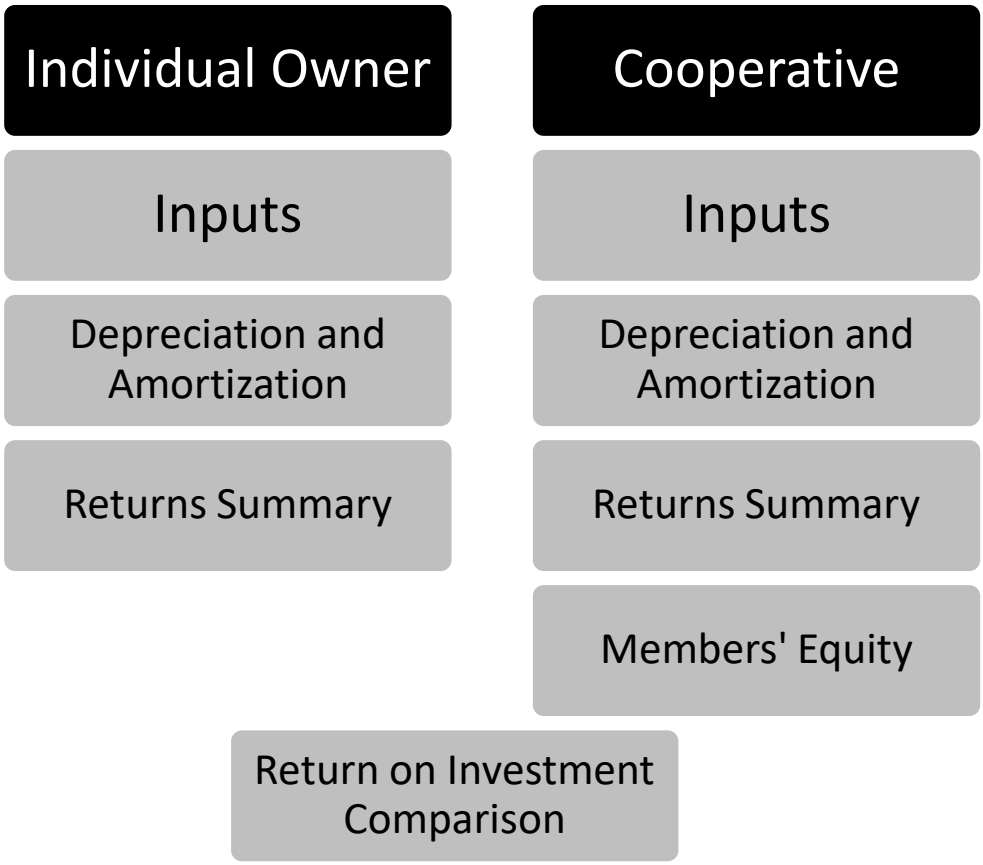

Figure 3.1: Sheets within the Spreadsheet Template Workbook

In order to illustrate how the spreadsheet can be used by veterinarians, a hypothetical case study was developed. The case study is designed to compare the financial impacts of an individual veterinary clinic expanding to offer imaging services to a four-veterinarian imaging cooperative. Before the case study scenario and results can be described in detail, data must be obtained to estimate hypothetical inputs for the case study, which is the focus of this chapter. Images of the spreadsheet, with base case study values, are included in the Appendices.

Facility Construction Costs

Costs to construct a veterinary imaging clinic were estimated using 2016 RSMeans construction cost data through a purchased academic subscription. The per-square-foot costs for various building structures were estimated using the RSMeans data for a veterinary hospital. Options for veterinarian users to specify the square feet of the facility, as well as contractor, architectural and user fees were included to match the reporting style of RSMeans. The default figures for these fees within the RSMeans software were 25%, 9%, and 0%, respectively for contractor, architectural and user fees. These figures can be modified by a veterinarian to fit unique scenarios. Because MRI suites require radiofrequency-shielding (RF), 2016 data for RF-shielded components were also obtained from the RSMeans software and included in the spreadsheet template. It is assumed a veterinary imaging cooperative would need to be housed in a separate facility, so one member veterinarian would not be favored over others by having the imaging equipment at his or her own facility.

Facility Expansion and Leasing Options

One potentially appealing option to an existing veterinary clinic is to simply expand the current facility space to incorporate an imaging clinic. Junk and Gilk (2007) estimate the cost to add an imaging suite onto an existing facility to range from $350-$400/sq. ft. in 2007 dollars. The cost for support space to be added onto an existing facility should range from $150-$200/sq. ft. (Junk and Gilk 2007). The midpoints of these two estimates were adjusted for inflation to 2016 dollars and are incorporated into the template as default values. A check for this estimate can be obtained using the Predesign Report for the University of Minnesota Veterinary Imaging Center (2007). After totaling the square footage of the initial construction for the facility and dividing the $1.7 million construction cost by the square feet, an estimated cost/sq. ft. of $420.17 can be obtained. Junk and Gilk (2007) also specify it would be more expensive to add an MRI facility to the basement or second story of an existing building, which could explain why the $420.17 estimate for the Minnesota facility is slightly higher than their range of $350-$400/sq. ft.

An option to lease diagnostic imaging space is also incorporated into the spreadsheet template for both individual veterinarians as well as a veterinary cooperative. Because leasing rates vary depending on a variety of factors including size, quality, and geographic location, a default estimate is not given.

Imaging Equipment

Multiple sources were utilized in compiling a list of possible equipment to include in a veterinary imaging clinic. Applicable equipment and estimated pricing were drawn from the 2016 RSMeans database for veterinary hospitals and for medical equipment. Additional veterinary-related MRI support equipment and estimated prices were obtained from the 2007 University of Minnesota Veterinary Imaging Predesign Report and adjusted for inflation. Lastly estimated prices for a 1.5T and 3T MRI scanner were obtained from Wood et al. (2011) and adjusted for inflation. A comprehensive list of equipment options and sources is shown in Table 3.1.

Table 3.1: Equipment Options for a Veterinary Imaging Clinic

Equipment Type	Estimated Purchase Price	Source
MRI Scanner Unit (1.5T)	$1,907,990	Wood et al. (2011)
MRI Scanner Unit (3T)	$2,819,199	Wood et al. (2011)
Mobile X-Ray Unit	$53,150	RSMeans (2016)
Stationary X-Ray Unit	$142,950	RSMeans (2016)
X-Ray Developing Processors	$9,263	RSMeans (2016)
Wall-Mounted Dental X-Ray Unit	$4,096	RSMeans (2016)
Panoramic Dental X-Ray Unit	$34,490	RSMeans (2016)
Dental X-Ray Developers	$8,140	RSMeans (2016)
Overhead, 4-post lift (1,000 lb. capacity)	$11,300	RSMeans (2016)
Overhead lift, track type (450 lb. capacity)	$3,725	RSMeans (2016)
MRI Equine table	$46,302	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
Major Surgery Table	$36,347	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
MRI Large Animal Anesthesia Machine	$86,816	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
MRI Small Animal Anesthesia Machine	$40,514	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)

Table 3.1: Equipment Options for a Veterinary Imaging Clinic

Equipment Type	Estimated Purchase Price	Source
MRI-compatible Injector for contrast (large & small animal)	$43,408	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
MRI-compatible monitoring equipment (large & small animal)	$66,559	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
Anesthesia Monitoring Equipment	$10,418	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
Kennel Fencing (1-1/2" mesh, 6' long, 3' - 6" wide, 6 - 2" tall)	$749.60	RSMeans (2016)
Kennel Fencing (1-1/2" mesh, 12' long, 3' - 6" wide, 6 - 2" tall)	$960.43	RSMeans (2016)
Kennel Fencing Top Cover (1-1/2" mesh, 6' long)	$200.52	RSMeans (2016)
Kennel Fencing Top Cover (1-1/2" mesh, 12' long)	$271.73	RSMeans (2016)
Kennel Doors (each)	$217.75	RSMeans (2016)
Directory Boards - Plastic, glass-covered (each)	$1,191.90	RSMeans (2016)
Surveillance Camera and Monitor	$2,070.60	RSMeans (2016)
For each additional security camera, must already have camera & monitor	$1,118.60	RSMeans (2016)
X-Ray Concrete Slabs (per sq. ft.)	$200	RSMeans (2016)
Prefabricated RF-Shielded Floor Panel, 5 oz. copper (per sq. ft. surf.)	$7.44	RSMeans (2016)
Prefabricated RF-Shielded Floor Panel, 12 oz. copper (per sq. ft. surf.)	$12.52	RSMeans (2016)
Prefabricated RF-Shielded Ceiling Panel, 5 oz. copper (per sq. ft. surf.)	$12.73	RSMeans (2016)
Prefabricated RF-Shielded Ceiling Panel, 12 oz. copper (per sq. ft. surf.)	$18.55	RSMeans (2016)
Prefabricated RF-Shielded Wall Panel, 5 oz. copper (per sq. ft. surf.)	$12.73	RSMeans (2016)
Prefabricated RF-Shielded Wall Panel, 12 oz. copper (per sq. ft. surf.)	$18.55	RSMeans (2016)
RF Shielded Door	$9,655	RSMeans (2016)

Capital Structure/Financing Assumptions

An underlying assumption is an individual veterinarian finances 50% of his or her total property, plant and equipment needs at a long-term interest rate of 7.5%. Like many other legal business structures, cooperatives are often funded with a combination of raised equity supplemented with debt financing. In this example, the capital expenditures are financed with

50% debt. The additional 50% in raised equity is divided proportionally among member veterinarians based on their projected service revenue. Financing is obtained by a cooperative as a single entity, rather than each member being responsible for their share of the debt. Although 50% is the default debt percentage used in this example, this value is variable in the spreadsheet template and can be adjusted based on member preferences. It is important to keep in mind that a higher initial equity investment means less debt financing, and less debt financing leads to a better cash flow position. Assuming the cooperative generates a profit, a better cash flow position will lead to an increased probability for higher patronage refunds.

Weighted Average Cost of Capital (WACC) can be an effective means to estimate a proper discount rate for capital investment analysis (Jones 2016), and is calculated using the following formula:

(3.1) $(WACC = (Cost\ of\ Equity * \%\ Equity\ Financing) + (Cost\ of\ Debt * \%\ Debt\ Financing)$

The base case study in the spreadsheet template assumes an equal, 50% proportion of debt and equity financing. The interest rate on debt is assumed to be 7.5%. Because equity is inherently riskier than debt, a cost of equity of 8.5% was assumed. Thus, a WACC of 8% was obtained and used as the discount rate for NPV analysis.

To ensure an imaging center can replace equipment as it wears out, the template has a built-in equipment replacement fund made up of the percentage of the initial equipment asset base reinvested each year. Depreciation is recalculated annually based on the net equipment balance (beginning balance plus additional reinvestment). Mechanisms to replace equipment are crucial for the cooperative to operate indefinitely into the future, but may also be useful for an individual veterinarian for managing the cash flow implications of purchasing and replacing expensive equipment. Since the equipment in the template is depreciated on a 7-year, straight-line basis, the amount reinvested each year must be greater than or equal to 1/7 (≈14.3%) of the initial equipment asset base in order to replace equipment as it is used up.

Following the guidelines proposed by Adler and Kuta (2011), an imaging facility should be managed by a combination of non-physician technicians and radiological specialists. In the model outlined in the spreadsheet template, an individual veterinary clinic's imaging facility is assumed to need one imaging specialist and one veterinary technician. Because it is operated by a single clinic and may even be located on the same property, a receptionist is not included. Due to its separate location and higher anticipated service volume, the cooperative imaging facility is assumedly managed by one imaging specialist, one veterinary technician, two veterinary assistants, and one receptionist. Salary and wage estimates were obtained from the U.S. Bureau of Labor Statistics Occupational Outlook Handbook.

For both individual and cooperative veterinarians, property taxes are assumed to be 0.05% of the total property, plant, and equipment needed. Per month expenses for electricity, water, gas, and telephone are assumed to be $1,000, $250, $1,000, and $200, respectively. Maintenance and insurance expenses, as a percentage of total property, plant and equipment are assumed to be 2% and 3%, respectively. Lastly, expenses are assumed to increase annually, at a rate of 2%.

Prior to the 1980s, individual tax rates were substantially lower than corporate tax rates, so farmer members of agricultural cooperatives preferred for patronage refunds to be distributed in the form of qualified stock (Briggeman et al. 2016). However, Briggeman et al. (2016) argue that effective corporate and individual tax rates are nearly the same under the current tax environment. Therefore, a moderately low default tax rate of 20% is used for both individual veterinarians and a veterinary cooperative in the spreadsheet template.

Services Offered and Shared Facility Use by Cooperative Members

The three types of services included as options in the spreadsheet template include MRI, X-Ray, and dental imaging for dogs, cats, and horses. Computed tomography (CT) is another popular advanced imaging technique, but was not included as a default option in the spreadsheet template. Costs to purchase CT scanners were found to vary significantly depending on the power

of the scanner and the resolution of the images it produces. In addition, Wright (2014) concluded an MRI scanner could perform nearly all the services a CT scanner provides to animal patients, albeit at a higher cost. MRI is the recommended practice for brain and spine imaging, while CT is recommended for nasal imaging, elbow imaging in young patients, incontinence imaging in immature patients, and pre-surgical evaluation before mass removal (Wright 2014). However, Wright (2014) determined MRI would yield similar information for nasal imaging, elbow imaging, and pre-surgical evaluation, but would cost more to perform. Therefore, given the data available, it was determined an imaging suite including MRI, X-ray, and dental imaging would be suitable for most imaging needs. If a user desires to add additional equipment and services, like CT, the spreadsheet template can be modified to incorporate these.

The Predesign Report for the University of Minnesota Veterinary Imaging Center (2007) estimated the range of fees charged for 1.5T MRI scans of dogs and cats to be $650-$800, so the midpoint ($725) was included as the default estimate in the spreadsheet template. The report also stated the better diagnostic capability of a 3.0T MRI scanner could warrant a fee of $1,000 for dog and cat scans, so this was included in the template as well. The Minnesota Predesign Report did not give an estimate for a 1.5T horse MRI scan, so no estimate for this service was included. An estimated charge of $1,600 for a 3.0T horse MRI scan was included in the report, so this figure was used in the spreadsheet template as a default estimate. All MRI service charge estimates were adjusted for inflation to 2016 dollars.

Anticipated charges for X-ray and dental imaging services were estimated using the 2012 AVMA Pet Demographic Survey, which included over 31,000 observations, and adjusted for inflation. Data was filtered so the only observations left were those that reported an expenditure for a desired service and nothing else, so their total expenditure amount was fully attributed to that desired service. This process was utilized for dog, cat, and horse X-ray and dental services. A summary of imaging service options included in the drop-down menus in the spreadsheet

template is shown in Table 3.2. Additional space is available if users desire to offer additional services not included in the drop-down menus.

Table 3.2: Default Options and Estimated Charges for Veterinary Imaging Services

Service	Estimated Charge	Source
1.5T Dog MRI Scan	$839	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
3T Dog MRI Scan	$1,158	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
Dog Dental Imaging	$247	2012 AVMA Pet Demographic Survey
Dog X-Ray	$178	2012 AVMA Pet Demographic Survey
1.5T Cat MRI Scan	$839	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
3T Cat MRI Scan	$1,158	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
Cat Dental Imaging	$281	2012 AVMA Pet Demographic Survey
Cat X-Ray	$158	2012 AVMA Pet Demographic Survey
3T Horse MRI Scan	$1,852	Predesign Report for the Univ. of Minnesota Veterinary Imaging Center (2007)
Horse Dental Imaging	$152	2012 AVMA Pet Demographic Survey

Default variable costs of imaging services were estimated using figures from Sistrom and McKay (2005). Although the focus of their research was human diagnostic imaging, cost data is difficult to acquire and these estimates should provide sufficient hypothetical default inputs for the spreadsheet template. These cells are variable to allow veterinarians to plug in their own variable cost estimates to increase the accuracy of their respective projections. Sistrom and McKay (2005) used data from hospitals in Florida to derive contribution margins for imaging services including computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine (NM), and diagnostic radiology (including X-ray). Contribution margin is a cost accounting measure defined as price less all variable costs (Investopedia 2017). It does not include any fixed or overhead expenses. By rearranging the equation for calculating a contribution margin percentage and applying contribution margin estimates from Sistrom and McKay (2005) to the service charge estimates described in the previous paragraph, variable costs for each service were calculated in the following manner:

(3.2) $Estimated\ Variable\ Cost\ = (1 - Contribution\ Margin\ \%) *$

$Estimated\ Service\ Charge$

It is important to note the estimated contribution margin from Sistrom and McKay (2005) for diagnostic radiography was used for both X-ray and dental imaging services, since both could fall under this categorical umbrella. One other key point to make is that the estimated variable cost data utilized by Sistrom & McKay (2005) was comprised of a combination of non-physician staffing, supplies, service contracts, leases, and other expenses. In an ideal scenario, non-physician staffing and equipment leases would be backed out of the estimates because they are accounted for in other areas of the spreadsheet template. This means the default estimates for variable costs are likely higher than they actually would be, underestimating profitability. It should also be noted that while variable costs would not change much across the human species, this would not likely be the case with animals, especially going from companion animals to horses. While it is acknowledged these estimates are indeed questionable, they should still prove adequate for a hypothetical case study scenario.

Table 3.3: Default Variable Costs for Veterinary Imaging Services

Service	Contribution Margin (Sistrom and McKay 2005)	Variable Cost per Service
1.5T Dog MRI Scan	91.94 %	$67.61
3T Dog MRI Scan	91.94 %	$93.26
Dog Dental Imaging	86.59%	$33.12
Dog X-Ray	86.59%	$23.91
1.5T Cat MRI Scan	91.94 %	$67.61
3T Cat MRI Scan	91.94 %	$93.26
Cat Dental Imaging	86.59%	$37.71
Cat X-Ray	86.59%	$21.21
3T Horse MRI Scan	91.94 %	$149.21
Horse X-Ray	86.59%	$35.06
Horse Dental Imaging	86.59%	$20.36

Initial Service Volume Estimates

Volume estimates for MRI services and associated annual growth rates were estimated using financial projections from the Predesign Report for the University of Minnesota Veterinary Imaging Center (2007). The University of Minnesota estimated a veterinary imaging center could

perform an average of 764 small animal MRIs per year during its first two years, with a growth rate of 3% thereafter. Horse MRIs per year were estimated to be 130 initially with a 3% annual growth rate in volume. Because the Minnesota Imaging Center was designed to contract with other veterinarians to provide imaging services, these estimates were selected as a baseline for the four-veterinarian imaging cooperative. Each veterinarian in the cooperative was assumed to be able to provide 1/4 of these estimated MRI services, or 191 small animal MRIs and 33 horse MRIs. The 191 small animal MRIs were further divided into dog and cat categories based on their respective proportions in the AVMA's 2012 Pet Demographic Survey. The individually-owned veterinary clinic was assumed to provide an equal number of services to each individual member in the imaging cooperative.

Volume estimates for dental imaging and X-ray services were derived using data from Neill and Holcomb (2017) and the 2012 AVMA Pet Demographic Survey. Neill and Holcomb (2017) estimated in a single year, a veterinarian provides services to 730 companion animals and/or 1,044 horses. The 2012 AVMA Pet Demographic Survey contained 15,880 dogs and 9,225 cats, so this proportion was used to divide the 730 companion animal visits into 462 dog visits per year and 268 cat visits per year, per veterinarian. For both dogs and cats, the total of each specific service performed during the year was divided by the total number of services per species to calculate the proportion of each species' services comprised of a specific type of service. Then that proportion was multiplied by the total number of services a single veterinarian provides to a species to estimate the number of each specific service that a veterinarian provided to a species in a year. For example, veterinarians performed 1,710 dog X-rays in 2012 (AVMA 2012). A single veterinarian provides approximately 462 services to dogs during the course of a year (Neill and Holcomb 2017). The number of X-rays performed by a single vet was calculated in the following manner:

(3.3) $$\frac{1{,}710\ (total\ dog\ X{-}rays\ in\ 2012)}{15{,}880\ (total\ dog\ services\ in\ 2012} = 10.77\%$$

$$10.77\% * 462\ (dog\ services\ per\ year, per\ vet) = \mathbf{50\ dog\ X-rays\ per\ year}$$

An identical procedure was used to calculate the initial service volume for dog dental imaging, cat dental imaging, cat X-ray, horse dental imaging, and horse X-ray services. A summary of the initial imaging service volumes and associated growth rates is shown in Table 3.4. The figures included in Table 3.4 represent the estimated number of services a single veterinarian could provide, either individually or as a member of a cooperative. So, for a four-veterinarian imaging cooperative, the total number of each service provided by the cooperative would be four times the quantity listed in Table 3.4.

Table 3.4: Initial Service Volumes for Veterinary Imaging Services and Growth Rates

Service	Initial Volume	Annual Growth Rate
3T Dog MRI Scan	121	3%
Dog Dental Imaging	62	3%
Dog X-Ray	50	3%
3T Cat MRI Scan	70	3%
Cat Dental Imaging	25	3%
Cat X-Ray	23	3%
3T Horse MRI Scan	33	3%
Horse X-Ray	90	3%
Horse Dental Imaging	351	3%

Profit Allocation and Patronage Refund Information

One reason the cooperative corporation was chosen as the legal structure for a shared veterinary imaging center is the potential benefits offered to member veterinarians. Investment and benefits are proportional with use in a cooperative, so returns above fixed and variable expenses will be distributed proportionally to veterinarian members in the form of cash patronage or nonqualified stock patronage. In this form of cooperative, members are required to invest the equity up-front to start the business, so a higher percentage of the refund will be in the form of cash. The default proportion in the template is an 85% cash refund and 10% nonqualified revolving stock refund. Cash patronage refunds are taxable income to cooperative members in the year it is distributed. Stock refunds are not taxable to members until they are redeemed for cash.

Because nonqualified stock is used, the cooperative receives a tax deduction when stock is redeemed by members for cash. Taxable income to the cooperative is comprised of pretax returns above all expenses less cash patronage distributions to members, less nonqualified stock redeemed by members during the year.

To formulate a strategy for relatively easy entry and exit for members, cooperatives typically establish revolving equity periods. These periods should roughly follow the financing period for equipment and provide opportune times for new members to join or for current members to exit. The default revolving period used in the spreadsheet template is 7 years, but can be adjusted to suit member veterinarians' preferences. Since the template only projects 10 years into the future, a revolving period of less than 10 years is needed for any effects of the stock patronage to be shown. Revolving stock and a specified quantity of usage rights help to provide a valuation upon which a member can sell their ownership rights to the cooperative. Ownership rights can be sold to a new member or purchased by current members to allow a veterinarian to exit the cooperative.

CHAPTER IV

CASE STUDY AND RESULTS

The base estimates in the spreadsheet template were designed to illustrate a hypothetical case study of a veterinary imaging clinic. The case study is designed in a way that the profitability of an individually-owned imaging center can be compared to an imaging cooperative. For the purposes of this case study, the imaging cooperative is comprised of four veterinarians providing equal levels of service. Four was selected as the number of member veterinarians for the case study in order to effectively show the gains from economies of size without using the spreadsheet template's maximum capacity of five. Equal levels of projected services ensures each member has an equal share invested in the imaging cooperative.

By definition, cooperative ownership is distributed on the basis of patronage, or usage (UWCC 2016). In the case of a veterinary imaging center, veterinarian members would "use" the cooperative by scheduling imaging services for their respective clients. Therefore, the spreadsheet template calculates required member investment and distributes earnings on the basis of projected gross margins from imaging services demanded by each veterinarian's clients (revenue from service charges less variable expenses from providing those services). Because each of the four members is assumed to provide an equal level of imaging services, they are each required to provide 25% of the total initial equity investment, own 25% of the cooperative, and receive 25% of the cash and stock patronage refunds.

While this example works well for case study projections, it does not account for the realistic scenario of veterinarians providing either more or less services than what was projected.

In a real-world situation, cooperative member veterinarians would need to provide their respective shares of the investment up-front, based on projections before any imaging services are actually provided. At the end of the year (or operating cycle), mechanisms would need to be written into the bylaws of the cooperative to account for over-usage and under-usage. Essentially, when veterinarians purchase membership in the cooperative, they would receive a specified quantity of usage rights based on their projected services. In order to provide more services than he or she was allowed based on usage rights, a member veterinarians would need to purchase additional rights from other members at an agreed-upon price.

In contrast to the cooperative scenario, the option to add-on an imaging suite to an existing clinic was selected for the individual veterinarian. Depending on the location and need for imaging services, this would likely be an attractive alternative for individual veterinarians, for both economic and geographic reasons. Junk and Gilk (2007) estimated an imaging suite would need 1,000 square feet for the operating room and equipment and 1,500 square feet for support space (areas for reception, patient screening, bathrooms, prep areas), so these figures were used in the case study example for individual ownership.

In this case study example, the veterinary imaging cooperative is assumed to construct a new imaging suite. Construction costs for building a new imaging suite were estimated using RSMeans construction data. Because the service volume estimates for the four-member imaging cooperative were taken from the Predesign Report for the University of Minnesota Veterinary Imaging Center (2007), the size of the Minnesota imaging center was used as a baseline for the shared imaging cooperative in the case study scenario. The four-veterinarian imaging cooperative is assumed to need 1,240 square feet for the imaging suite alone. In order to account for additional space that might be needed for multiple veterinarians to share the same space (e.g. separate offices or personal spaces), the 5,140 total square footage estimate from the Minnesota facility was rounded up to 5,500 for the case study example.

Similar equipment was selected for both the individually-owned clinic and the imaging cooperative in order to provide the same services for comparison. However, additional items were added for the cooperative because it was assumed more would be needed if four veterinarians would be sharing the facility (e.g. more surgery tables, additional kennel space, additional anesthesia machines). The Predesign Report for the University of Minnesota Veterinary Imaging Center (2007) was used as a guide for equipment quantities when applicable. Table 4.1 and Table 4.2 outline the base equipment selection for both the individually-owned veterinary imaging center and for the shared imaging cooperative, respectively.

Table 4.1: Case Study Equipment Selection for an Individually-Owned Veterinary Imaging Center

Equipment Type	Unit Cost	Quantity	Total Cost
MRI Scanner Unit (3T)	$2,819,199	1	$2,819,199
MRI-compatible monitoring equipment (large & small animal)	$66,559	1	$66,559
MRI-compatible Injector for contrast (large & small animal)	$43,408	1	$43,408
MRI Large Animal Anesthesia Machine	$86,816	1	$86,816
MRI Small Animal Anesthesia Machine	$40,514	1	$40,514
MRI Equine table	$46,302	1	$46,302
Stationary X-Ray Unit	$142,950	1	$142,950
X-Ray Developing Processors	$9,263	1	$9,263
Panoramic Dental X-Ray Unit	$34,490	1	$34,490
Dental X-Ray Developers	$8,140	1	$8,140
Anesthesia Monitoring Equipment	$10,418	1	$10,418
Major Surgery Table	$36,347	2	$72,694
Overhead, 4-post lift (1,000 lb. capacity)	$11,300	1	$11,300
Overhead lift, track type (450 lb. capacity)	$3,725	1	$3,725
Kennel Doors (each)	$218	4	$871
Kennel Fencing (1-1/2" mesh, 12' long, 3' - 6" wide, 6 - 2" tall)	$960	2	$1,921
Kennel Fencing Top Cover (1-1/2" mesh, 12' long)	$272	2	$543
Kennel Fencing Top Cover (1-1/2" mesh, 6' long)	$201	4	$802
Surveillance Camera and Monitor	$2,071	1	$2,071
For each additional security camera, must already have camera & monitor	$1,119	1	$1,119
Total Individual Equipment Cost			**3,403,102**

Table 4.2: Case Study Equipment Selection for an Four-Veterinarian Imaging Cooperative

Equipment Type	Unit Cost	Quantity	Total Cost
MRI Scanner Unit (3T)	$2,819,199	1	$2,819,199
MRI-compatible monitoring equipment (large & small animal)	$66,559	1	$66,559
MRI-compatible Injector for contrast (large & small animal)	$43,408	1	$43,408
MRI Large Animal Anesthesia Machine	$86,816	1	$86,816
MRI Small Animal Anesthesia Machine	$40,514	3	$121,542
MRI Equine table	$46,302	1	$46,302
Stationary X-Ray Unit	$142,950	1	$142,950
X-Ray Developing Processors	$9,263	1	$9,263
Panoramic Dental X-Ray Unit	$34,490	1	$34,490
Dental X-Ray Developers	$8,140	1	$8,140
Anesthesia Monitoring Equipment	$10,418	1	$10,418
Major Surgery Table	$36,347	4	$145,387
Overhead, 4-post lift (1,000 lb. capacity)	$11,300	1	$11,300
Overhead lift, track type (450 lb. capacity)	$3,725	1	$3,725
Kennel Doors (each)	$218	8	$1,742
Kennel Fencing (1-1/2" mesh, 12' long, 3' - 6" wide, 6 - 2" tall)	$960	4	$3,842
Kennel Fencing Top Cover (1-1/2" mesh, 12' long)	$272	4	$1,087
Kennel Fencing Top Cover (1-1/2" mesh, 6' long)	$201	8	$1,604
Surveillance Camera and Monitor	$2,071	1	$2,071
For each additional security camera, must alreadt have camera & monitor	$1,119	1	$1,119
Total Cooperative Equipment Cost			**$3,560,961**

Case Study Base Results

Individual Income and Expense Analysis

Under the base assumptions, an individually-owned veterinary imaging center generates a loss each year of the 10-year projection horizon. Because of their costly service charges, MRIs are projected to generate more revenue than other services with the most being generated by dog MRI scans, followed by cat MRI scans, and horse MRI scans. These three services combine to generate 72% of revenue the first year. Despite having the highest initial volume, horse dental imaging ranks fourth in revenue the first year, accounting for approximately 14%.

Depreciation on buildings and equipment, because of the large initial investment required for PP&E, ranks as the largest expense category at nearly 50% of total expenses for the first year. Interest expense ranks second at 15%, followed by maintenance expenses at 12%. All other

expense categories account for less than 10% of total expenses the first year. Largely driven by over $500,000 in depreciation expenses the first year, an individually-owned veterinary imaging center is projected to generate a loss of $674,788 before taxes during its first year of operation. Detailed revenue and expense figures for the first year are outlined in Table 4.3. It should be noted that these financial estimates are a product of the base input assumptions. Varying costs for facilities and equipment, along with changes to debt financing assumptions will alter these values.

Table 4.3: Revenue and Expense Projections for an Individually-Owned Veterinary Imaging Center – First Year

	Estimate	% of Total Revenue
3T Dog MRI Scan	$139,875	36%
3T Cat MRI Scan	$81,256	21%
3T Horse MRI Scan	$60,192	15%
Cat Dental Imaging	$6,931	2%
Dog X-Ray	$8,861	2%
Cat X-Ray	$3,706	1%
Dog Dental Imaging	$15,249	4%
Horse X-Ray	$23,414	6%
Horse Dental Imaging	$53,293	14%
Revenue - Veterinary Imaging Services	**392,776**	**100%**
	Estimate	% of Total Expenses
Variable Costs for Providing Imaging Services	$37,616	4%
Personnel Expense for Salary Employees	$75,556	7%
Personnel Expense for Hourly Employees	$31,724	3%
Depreciation on Buildings and Equipment	$505,079	48%
Maintenance Expenses	$124,231	12%
Insurance Expenses	$82,821	8%
Property Tax	$20,705	2%
Interest Expense	$155,289	15%
Utility Expenses	$29,400	3%
Total Veterinary Imaging Services Expenses	**$1,062,420**	**100%**
Pretax Income (Loss)	**($669,645)**	

Profitability does improve year-over-year, however. By the end of Year 10, the individually-owned veterinary imaging center is projected to generate a pretax loss of less than $475,000, an improvement of nearly $200,000 compared to Year 1. This improvement in profitability is largely due to growth in the number of services provided and a decline in interest expense as the loan balance is paid down. In order to illustrate how revenues and expenses are

projected to change over the course of the projection period, Table 4.4 outlines the first five years of operation.

Table 4.4: Revenue and Expense Projections for an Individually-Owned Veterinary Imaging Center – First Five Years of Operation

	Year 1	Year 2	Year 3	Year 4	Year 5
3T Dog MRI Scan	$139,875	$144,071	$148,393	$152,845	$157,430
3T Cat MRI Scan	$81,256	$83,694	$86,205	$88,791	$91,454
3T Horse MRI Scan	$60,192	$61,998	$63,858	$65,774	$67,747
Cat Dental Imaging	$6,931	$7,139	$7,353	$7,573	$7,801
Dog X-Ray	$8,861	$9,127	$9,400	$9,682	$9,973
Cat X-Ray	$3,706	$3,817	$3,931	$4,049	$4,171
Dog Dental Imaging	$15,249	$15,707	$16,178	$16,663	$17,163
Horse X-Ray	$23,414	$24,116	$24,840	$25,585	$26,353
Horse Dental Imaging	$53,293	$54,891	$56,538	$58,234	$59,981
Less: Variable Costs for Providing Imaging Services	($37,616)	($38,368)	($39,136)	($39,919)	($40,717)
Gross Margin-Veterinary Imaging Services	**$355,159**	**$366,192**	**$377,563**	**$389,282**	**$401,360**
Personnel Expense for Salary Employees	$75,556	$77,067	$78,608	$80,181	$81,784
Personnel Expense for Hourly Employees	$31,724	$32,358	$33,005	$33,665	$34,339
Depreciation on Buildings and Equipment	$505,079	$505,218	$505,267	$505,310	$505,346
Maintenance Expenses	$124,231	$126,716	$129,250	$131,835	$134,472
Insurance Expenses	$82,821	$84,477	$86,167	$87,890	$89,648
Property Tax	$20,705	$21,119	$21,542	$21,972	$22,412
Interest Expense	$155,289	$137,617	$118,620	$98,197	$76,244
Utility Expenses	$29,400	$29,988	$30,588	$31,200	$31,824
Total Veterinary Imaging Services Expenses	**$1,024,804**	**$1,014,560**	**$1,003,047**	**$990,250**	**$976,068**
Pretax Income (Loss)	**($669,645)**	**($648,370)**	**($625,487)**	**($600,972)**	**($574,712)**

Cooperative Income, Expense, and Equity Analysis

Taking advantage of economies of size gained through the additional three veterinarians, the shared imaging cooperative is projected to be more financially successful than the individually-owned clinic, generating a profit each of the 10 years on the projection horizon.

Economies of size allow cooperative member veterinarians to take advantage of shared financial risks and less debt-financing per member, increase their use of facilities and equipment, and more efficiently use personnel compared to an individually-owned clinic. Because each of the four member veterinarians is projected to provide the same number of services as the single veterinarian in the individual scenario, the cooperative generates exactly four times as much revenue, about $1.57 million in total the first year. The breakdown of each service as a proportion of revenue is identical to the individual scenario, so this breakdown is not shown in Table 4.5. Similar to the individually-owned imaging center scenario, depreciation on buildings and equipment represents the largest expense category, accounting for nearly 40% of expenses during the first year. The next largest expense categories are projected to be interest expense (13%), variable expenses for providing imaging services (11%), and maintenance expenses (10%) during the first year. Before patronage distributions, the cooperative imaging center is projected to generate net income of $186,058 during the first year. A detailed breakdown for Year 1 revenue and expense projections is shown in Table 4.5.

Table 4.5: Revenue and Expense Projections for a Shared Veterinary Imaging Cooperative-First Year

Revenue - Veterinary Imaging Services	**$1,571,102**	
	Estimate	% of Total Expenses
Variable Costs for Providing Imaging Services	$150,465	11%
Personnel Expense for Salary Employees	$106,262	8%
Personnel Expense for Hourly Employees	$111,046	8%
Depreciation on Buildings and Equipment	$541,215	39%
Maintenance Expenses	$144,861	10%
Insurance Expenses	$96,574	7%
Property Tax	$24,144	2%
Interest Expense	$181,077	13%
Utility Expenses	$29,400	2%
Total Veterinary Imaging Services Expenses	**$1,385,044**	**100%**
Net Income Before Patronage	**$186,058**	

Cooperative profits increase substantially over the course of the 10-year time period projected in the spreadsheet template. By the end of Year 10, the cooperative imaging center is projected to generate income of over $700,000 prior to patronage distributions and income tax.

Similar to the individual scenario, the increase in profitability is largely due to growth in the number of services provided each year and a decline in interest expense due to the loan balance being paid down. This can be seen in Table 4.6, which outlines how income and expense categories change during the first five years of operation for the shared imaging cooperative.

Table 4.6: Revenue and Expense Projections for a Shared Veterinary Imaging Cooperative– First Five Years of Operation

	Year 1	Year 2	Year 3	Year 4	Year 5
Veterinary Imaging Service Revenue	$1,571,102	$1,618,235	$1,666,782	$1,716,786	$1,768,290
Less: Variable Costs for Providing Imaging Services	($150,465)	($153,474)	($156,543)	($159,674)	($162,868)
Gross Margin-Veterinary Imaging Services	$1,420,638	$1,464,762	$1,510,239	$1,557,112	$1,605,422
Personnel Expense for Salary Employees	$106,262	$110,555	$112,766	$115,021	$117,322
Personnel Expense for Hourly Employees	$111,046	$113,267	$115,532	$117,843	$120,200
Depreciation on Buildings and Equipment	$541,215	$541,361	$541,413	$541,457	$541,495
Maintenance Expenses	$144,861	$147,759	$150,714	$153,728	$156,803
Insurance Expenses	$96,574	$98,506	$100,476	$102,485	$104,535
Property Tax	$24,144	$24,626	$25,119	$25,621	$26,134
Interest Expense	$181,077	$160,470	$138,318	$114,505	$88,905
Utility Expenses	$29,400	$29,988	$30,588	$31,200	$31,824
Total Veterinary Imaging Services Expenses	**$1,234,579**	**$1,226,532**	**$1,214,925**	**$1,201,860**	**$1,187,217**
Pretax Income (Loss)	**$186,058**	**$238,230**	**$295,314**	**$355,251**	**$418,205**

In order to better understand how a veterinary cooperative would benefit its members, a more thorough examination of how net returns are distributed to members is needed. Recall that, per base figures for this case study specified in Chapter III, 85% of returns above variable and fixed expenses will be distributed to members in the form of cash patronage. Ten percent will be distributed in the form of nonqualified common stock, while the remaining 5% is left unallocated.

Of the $186,058 in projected income before patronage for the first year, $158,150 is distributed to members in the form of cash. $18,606 is distributed to members in the form of nonqualified common stock. Income tax is paid by the cooperative on the remaining income after deducting the amount of cash patronage distributed to members, as well as any nonqualified common stock redeemed. In the current case study example, the revolving period for common stock is 7 years, so the effects of stock redemption would not be visible until Year 8. In order to see how income is distributed and tax is paid, including the effects of stock redemption, the five-year projection shown in Table 4.7 outlines Year 1 and Years 7-10.

Table 4.7: Cash Patronage Distribution and Income Tax Payment

	Year 1…	Year 7	Year 8	Year 9	Year 10
Income before Patronage Refunds	**$186,058…**	**$553,861**	**$626,943**	**$669,615**	**$713,724**
Less: Cash Patronage Refunded to Members	$158,150…	$470,782	$532,902	$569,173	$606,666
Less: Common Stock Patronage Redeemed	$0…	$0	$18,606	$23,823	$29,531
Before Tax Savings	**$27,909…**	**$83,079**	**$75,436**	**$76,619**	**$77,527**
Less: Income Tax (20% Rate)	$5,582…	$16,616	$15,087	$15,324	$15,505
Net Savings After Tax	**$22,327…**	**$66,463**	**$60,348**	**$61,295**	**$62,022**

While Table 4.7 provides a necessary illustration of how income is distributed to members and how cooperative income tax is calculated, a further illustration is needed to outline how equity flows into and out of the cooperative as it is issued and revolved. The Cooperative Equity page of the spreadsheet template represented by Table 4.8 demonstrates the mechanisms by which equity flows through the shared imaging cooperative. As in Table 4.7, Years 1 and 7-10 are shown so the effects of stock redemption are visible. The initial $2.4 million in cooperative membership stock represents the original equity put up by cooperative members, which is the non-debt-financed portion of the total property, plant, and equipment investment. New stock issued to members is the 10% of returns distributed to members in the form of nonqualified common stock. The spreadsheet template also has a mechanism to account for preferred stock, but none is included in the case study to keep it as simple as possible. Unallocated equity

represents the proportion of income not distributed to members in the form of cash or stock, 5% in this case. The unallocated equity provides a cushion fund which could be reduced if the cooperative experiences a loss, allowing the cooperative to avoid writing down the value of the revolving stock.

Table 4.8: Cooperative Equity

	Year 1…	Year 7	Year 8	Year 9	Year 10
Co-Op Membership Stock	$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358
New Common Stock Issued	$18,606	$55,386	$62,694	$66,962	$71,372
Common Stock Redeemed	$0	$0	$18,606	$23,823	$29,531
Common Stock Balance	$18,606	$253,127	$297,215	$340,354	$382,195
Preferred Stock	$0	$0	$0	$0	$0
Unallocated Equity	$7,442	$101,251	$126,328	$153,113	$181,662
Total Members' Equity	**$2,440,406**	**$2,768,735**	**$2,837,901**	**$2,907,824**	**$2,978,214**

Overall Investment Return Comparison

After subtracting variable and fixed expenses from the gross margin of providing imaging services, depreciation and term interest were added back in to calculate cash benefits less costs for comparison as a capital investment. Net present value (NPV) and internal rate of return (IRR) were used as capital investment evaluation techniques. Return on assets (ROA) and return on equity (ROE) were also used as measures of financial performance to compare the individually-owned veterinary imaging center to the four-member imaging cooperative. Generally accepted accounting principles (GAAP) were used as a guideline for ROA and ROE formulas. ROA was calculated by dividing after-tax income by the total property, plant, and equipment investment required. ROE was calculated by dividing after-tax income by the non-borrowed portion of the total property, plant, and equipment investment required.

In summary, using a 10-year projection horizon, the investment in an individually-owned veterinary imaging clinic outlined in the case study has an NPV of -$4,092,886. IRR of -33.87% means this investment loses nearly 34% of its starting value after accounting for cash operating expenses. Average ROA and ROE over the course of the 10-year period are projected to be

-13.57% and -27.14%, respectively. Under the current set of assumptions, it is evident why small and independent veterinarians would not likely be able to afford to expand their practices to incorporate imaging services. Given the extremely large initial investment in equipment and facilities required, paired with a negative net income each year, this is a very unattractive investment opportunity. As was shown previously, depreciation expense is the primary contributor to the negative net income each year, driven by the initial construction of an imaging suite and purchase of equipment. The individually owned clinic is simply not generating enough revenue to overcome the fixed costs of opening and operating an imaging center during the 10-year projection horizon.

For comparative purposes, the same calculations and evaluation techniques were used for the four-member imaging cooperative model. As shown previously, the cooperative scenario generates a profit each of the ten years projected. It is important to note that this comparison between the individual and cooperative scenarios has nothing to do with how cooperative returns are distributed. It simply shows what can be gained through the economies of size of a four-veterinarian clinic compared to a single-veterinarian clinic. The cooperative imaging center generates four times as much revenue as the individually-owned clinic and has only slightly higher fixed expenses, leading to much lower fixed expenses per member. For the four-member cooperative scenario, the capital investment in a shared imaging center has an NPV of $2,134,278 and an IRR of 16.46%. Average ROA and ROE over the 10-year period are 9.15% and 18.31%, respectively.

Keep in mind that for both the individual and cooperative scenarios, average ROE was exactly double average ROA. This is because it was assumed both investments would be financed with 50% debt and 50% equity. In order to make ROE comparisons, both the individual and cooperative scenarios should have the same initial debt/equity ratio. Table 4.9 summarizes the economies of size gained by going from a single-veterinarian imaging center to a four-veterinarian imaging center.

Table 4.9: Overall Investment Return Summary Comparison

	Individually-Owned Imaging Center	Four-Veterinarian Imaging Cooperative
Total Initial PP&E Investment	$4,141,035	$4,828,715
Net Present Value (NPV)	-$4,092,886	$2,134,278
Internal Rate of Return (IRR)	-33.87%	16.46%
10-Year Average Return on Assets (ROA)	-13.57%	9.15%
10-Year Average Return on Equity (ROE)	-27.14%	18.31%

Cash Return Comparison

A separate comparison is needed to examine the returns to each cooperative member. Although the previous comparison provides an overview of the cooperative business as a whole, each member is only required to put up his or her percentage share of the initial equity investment and only receives that same share of the returns through cash and stock patronage refunds. Table 14 illustrates the projected cash return to each cooperative member over the first five years. Only one member is illustrated in the table because each of the four members in the case study scenario is an equal owner, as described previously. The spreadsheet template, however, breaks down cash returns for each of the five members so ownership percentages can be varied. The initial equity investment in Table 4.10 represents each member's ownership share in the cooperative times the non-debt-funded portion of the total property, plant, and equipment investment. The calculation for each member's taxable income is outlined in equation 4.1.

(4.1) $Taxable\ Income = \%\ Share\ in\ Cooperative * (Total\ Cash\ Patronage\ Refund + Common\ Stock\ Redeemed)$

A separate income tax rate variable for cooperative members is located on the "Cooperative Inputs" page of the spreadsheet template. To keep consistency with the 20% rate assumed for the individually-owned veterinary imaging center, a rate of 20% was assumed for cooperative members as well.

Table 4.10: Individual Cooperative Member Returns

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Member Initial Equity Investment	$603,589	-	-	-	-	-
Member Taxable Income	-	$39,537	$50,624	$62,754	$75,491	$88,869
Member Income Tax	-	$7,907	$10,125	$12,551	$15,098	$17,774
Member After-Tax Income	**-$603,589**	**$31,630**	**$40,499**	**$50,203**	**$60,393**	**$71,095**
Member Return on Investment (ROI)		**5.24%**	**6.71%**	**8.32%**	**10.01%**	**11.78%**

Under the current set of assumptions, cooperative members are projected to earn an average return on investment (ROI) of 13.03% annually over the 10-year period. However, this figure does not account for the time value of money, and is weighted by higher returns later in the life of the investment. IRR accounts for the time value of money, and each cooperative member is projected to see an internal rate of return of 4.15% on their personal cash investment and returns over the 10-year time period analyzed. Although 4.15% is a positive return, it is less than the 8% weighted average cost of capital (WACC) used as the discount rate for NPV analysis, resulting in a negative net present value.

In order to compare the returns for each individual cooperative member to the returns an individually-owned clinic could expect to see, variable and fixed expenses were subtracted from the gross margin of providing imaging services, and then depreciation and term interest were added back in to arrive at a figure for cash benefits less costs. This is a similar process to what was used to evaluate the overall profitability of an individually-owned imaging center, but in this case, only the equity-financed portion of the initial investment was used for analysis in order to more closely compare to cooperative members. Table 4.11 compares the cash returns of an individually-owned imaging center to the cash returns each cooperative member could expect to see under the same assumptions. It should be noted that cooperative members, as well as an individual veterinarian, would retain ownership of a fully-functioning clinic with adequate

equipment at the end of the ten-year period. Projected returns do not reflect the value of the remaining facility and equipment.

Table 4.11: Cash Returns for Individual Ownership compared to Cooperative Members

	Initial Equity Investment	Average 10-Year Return on Investment	Net Present Value (NPV)	Internal Rate of Return (IRR)
Individual Owner	$2,070,517	0.48%	-$2,022,369	-33.60%
Co-op Member	$603,589	13.03%	-$122,267	4.15%

Sensitivity Analysis

Sensitivity analysis is needed to test the financial impact of changes to key input variables. Inputs that were varied include initial imaging service volumes, charges for imaging services, cost to purchase equipment, imaging service growth rates, long-term interest rate, percentage of cooperative returns distributed to cash patronage refunds, percentage of total PP&E investment financed with debt, discount rate for NPV analysis, and size of the imaging suite. Table 4.12 on the following page compares the base estimates of NPV, IRR, ROA and ROE for overall individual and cooperative returns to values for the same return measures obtained by varying key inputs.

Table 4.12: Sensitivity of Overall Individual Owner and Cooperative Returns

	Overall Individual Return			
	NPV	**IRR**	**ROA**	**ROE**
Base Case Study Scenario	-$4,092,886	-33.87%	-13.57%	-27.14%
Increase Initial Volume 5%	-$3,958,258	-28.44%	-13.07%	-26.15%
Decrease Initial Volume 5%	-$4,227,514	-	-14.06%	-28.13%
Increase Service Charge 5%	-$3,958,258	-28.44%	-13.07%	-26.15%
Decrease Service Charge 5%	-$4,227,514	-	-14.06%	-28.13%
Increase Equipment Cost 5%	-$4,330,949	-	-13.90%	-27.80%
Decrease Equipment Cost 5%	-$3,854,824	-30.55%	-13.21%	-26.42%
Increase Service Growth Rate from 3% to 5%	-$3,844,094	-21.98%	-12.51%	-25.02%
Decrease Service Growth Rate from 3% to 1%	-$4,318,245	-	-14.52%	-29.04%
Increase Interest Rate from 7.5% to 8.5%	-$4,092,886	-33.87%	-13.80%	-27.60%
Decrease Interest Rate from 7.5% to 6.5%	-$4,092,886	-33.87%	-13.34%	-26.68%
Increase Cash Patronage Refund from 85% to 90%				
Decrease Cash Patronage Refund from 85% to 80%				
Increase % Debt Financing from 50% to 60%	-$4,092,886	-33.87%	-13.89%	-34.73%
Decrease % Debt Financing from 50% to 40%	-$4,092,886	-33.87%	-13.25%	-22.08%
Increase Discount Rate from 8% to 10%	-$4,100,993	-33.87%	-13.57%	-27.14%
Decrease Discount Rate from 8% to 6%	-$4,083,198	-33.87%	-13.57%	-27.14%
Increase Imaging Suite Size by 250 sq. ft.	-$4,244,715	-	-13.48%	-26.97%
Decrease Imaging Suite Size by 250 sq. ft.	-$3,941,058	-31.67%	-13.66%	-27.32%
	Overall Cooperative Return			
	NPV	**IRR**	**ROA**	**ROE**
Base Case Study Scenario	$2,134,278	16.46%	9.15%	18.31%
Increase Initial Volume 5%	$2,658,834	18.36%	10.81%	21.61%
Decrease Initial Volume 5%	$1,609,721	14.50%	7.50%	15.00%
Increase Service Charge 5%	$2,658,834	18.36%	10.81%	21.61%
Decrease Service Charge 5%	$1,609,721	14.50%	7.50%	15.00%
Increase Equipment Cost 5%	$1,891,865	15.31%	8.07%	16.13%
Decrease Equipment Cost 5%	$2,376,690	17.67%	10.32%	20.65%
Increase Service Growth Rate from 3% to 5%	$3,100,510	19.27%	12.67%	25.35%
Decrease Service Growth Rate from 3% to 1%	$1,258,978	13.47%	5.99%	11.98%
Increase Interest Rate from 7.5% to 8.5%	$2,136,240	16.47%	8.93%	17.85%
Decrease Interest Rate from 7.5% to 6.5%	$2,132,347	16.45%	9.38%	18.75%
Increase Cash Patronage Refund from 85% to 90%				
Decrease Cash Patronage Refund from 85% to 80%				
Increase % Debt Financing from 50% to 60%	$2,137,011	16.47%	8.84%	22.09%
Decrease % Debt Financing from 50% to 40%	$2,131,544	16.45%	9.47%	15.78%
Increase Discount Rate from 8% to 10%	$1,514,315	16.46%	9.15%	18.31%
Decrease Discount Rate from 8% to 6%	$2,849,899	16.46%	9.15%	18.31%
Increase Imaging Suite Size by 250 sq. ft.	$2,058,232	16.10%	8.94%	17.88%
Decrease Imaging Suite Size by 250 sq. ft.	$2,210,323	16.83%	9.37%	18.75%

Similarly, Table 4.13 illustrates how the estimated cash returns to an individual owner or a cooperative member would change in response to the same input changes in Table 16. For a more complete overview of the sensitivity of these inputs, both NPV and ROI estimates are used.

Table 4.13: Sensitivity of Individual Owner and Cooperative Cash Returns

	Individual Owner Cash Returns		
	ROI	**NPV**	**IRR**
Base Case Study Scenario	0.48%	-$2,022,369	-33.60%
Increase Initial Volume 5%	1.47%	-$1,887,741	-26.36%
Decrease Initial Volume 5%	-0.50%	-$2,156,997	-
Increase Service Charge 5%	1.47%	-$1,887,741	-26.36%
Decrease Service Charge 5%	-0.50%	-$2,156,997	-
Increase Equipment Cost 5%	-0.01%	-$2,175,354	-39.97%
Decrease Equipment Cost 5%	1.02%	-$1,869,384	-29.16%
Increase Service Growth Rate 2%	2.60%	-$1,773,577	-19.64%
Decrease Service Growth Rate 2%	-1.42%	-$2,247,728	-
Increase Interest Rate by 1%	0.48%	-$2,022,369	-33.60%
Decrease Interest Rate by 1%	0.48%	-$2,022,369	-33.60%
Increase Cash Patronage Refund by 5%			
Decrease Cash Patronage Refund by 5%			
Increase % Debt Financing by 10%	0.61%	-$1,608,266	-31.78%
Decrease % Debt Financing by 10%	0.40%	-$2,436,473	-35.05%
Increase Discount Rate from 8% to 10%	0.48%	-$2,030,475	-33.60%
Decrease Discount Rate from 8% to 6%	0.48%	-$2,012,680	-33.60%
Increase Imaging Suite Size by 250 sq. ft.	0.16%	-$2,119,938	-37.29%
Decrease Imaging Suite Size by 250 sq. ft.	0.82%	-$1,924,800	-30.64%
	Cooperative Member Cash Returns		
	ROI	**NPV**	**IRR**
Base Case Study Scenario	13.03%	-$122,267	4.15%
Increase Initial Volume 5%	15.41%	-$28,520	7.13%
Decrease Initial Volume 5%	10.65%	-$216,014	0.93%
Increase Service Charge 5%	15.41%	-$28,520	7.13%
Decrease Service Charge 5%	10.65%	-$216,014	0.93%
Increase Equipment Cost 5%	11.47%	-$190,742	2.06%
Decrease Equipment Cost 5%	14.71%	-$53,792	6.28%
Increase Service Growth Rate 2%	17.99%	$47,832	9.31%
Decrease Service Growth Rate 2%	8.57%	-$276,419	-2.41%
Increase Interest Rate by 1%	12.70%	-$137,814	3.67%
Decrease Interest Rate by 1%	13.36%	-$106,926	4.62%
Increase Cash Patronage Refund by 5%	13.66%	-$97,938	4.95%
Decrease Cash Patronage Refund by 5%	12.40%	-$146,596	3.32%
Increase % Debt Financing by 10%	15.70%	-$23,494	7.14%
Decrease % Debt Financing by 10%	11.25%	-$221,039	1.83%
Increase Discount Rate from 8% to 10%	13.03%	-$172,647	4.15%
Decrease Discount Rate from 8% to 6%	13.03%	-$63,473	4.15%
Increase Imaging Suite Size by 250 sq. ft.	12.72%	-$135,877	3.75%
Decrease Imaging Suite Size by 250 sq. ft.	13.35%	-$108,656	4.55%

Figures 4.1- 4.8 were created to more closely analyze the financial impacts presented in Tables 4.12 and 4.13. It is important to note that some input changes were omitted from certain graphs because not all changes generate financial impacts. For example changes in cash patronage distributions do not affect any of the calculations related to an individually-owned imaging center, and NPV calculations for the total businesses are not affected by the relative proportions of debt and equity in the initial investment. In addition, it should be considered that inputs were not consistently varied by the same percentage from the baseline. It would not be assumed, for example, variables for interest rate and equipment cost would have the same distribution, so it would not make sense to vary them by a set, consistent proportion from the baseline. If more complete data had been available, it would have been possible to estimate a distribution for each input variable, leading to a more comprehensive sensitivity analysis.

Sensitivity of Overall Individual Owner Returns

Of the specific changes tested, increasing the growth rate for imaging services from 3% to 5% has the greatest positive impact on the overall returns to an individually-owned veterinary imaging center. In response to this increase in the service growth rate, NPV increases by nearly $250,000. The greatest negative impact on NPV is generated by a 5% increase in the initial equipment cost. This change causes the projected 10-year NPV to decrease $238,063. The smallest impacts are generated by increasing the discount rate from 8% to 10%, or decreasing it to 6%. These impacts, as well as others, are shown in Figure 4.1.

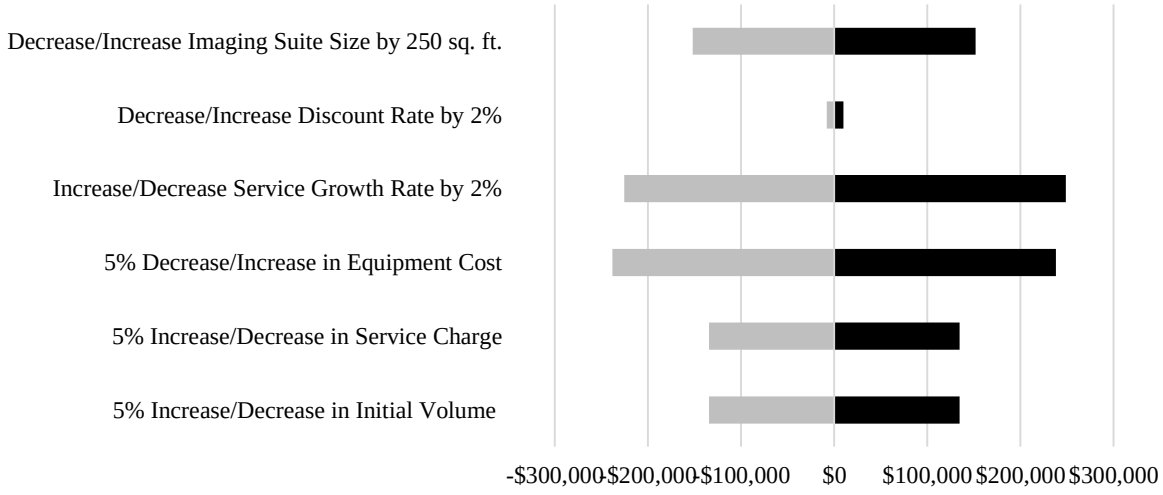

Figure 4.1: Change in Overall Individual Return – NPV (Base Estimate = -$4,092,886)

Figure 4.2 shows how key input changes affect Overall Individual ROE. The magnitude of change to resulting from increasing the proportion of debt financing from 50% to 60%, or decreasing it to 40% makes it difficult to visualize the impact of other input changes. ROE is heavily affected by the initial debt-equity ratio, which is why it is critical to use a variety of measures to evaluate the feasibility of a large investment such as this one. The smallest impacts on Overall Individual ROE are produced by increasing or decreasing the size of the veterinary imaging suite by 250 square feet.

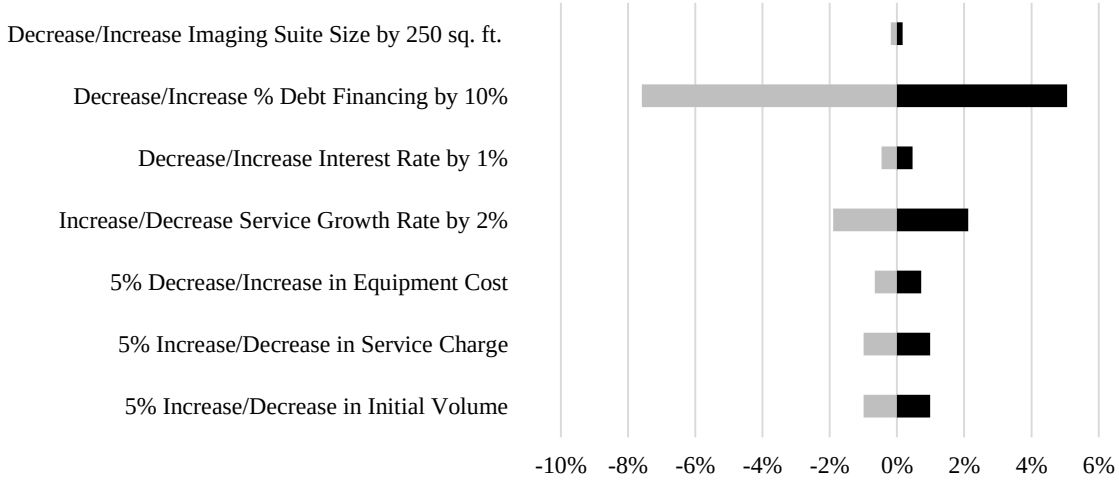

Figure 4.2: Change in Overall Individual Return - ROE (Base Estimate = -27.14%)

Sensitivity of Overall Cooperative Returns

For comparison, Figure 4.3 shows how the projected NPV for Overall Cooperative Returns changes in response to changes in key inputs. Similar to the individually-owned imaging center scenario, changing the 3% service growth rate to either 5% or 1% generates the largest impacts. However, changing the 8% discount rate to either 10% or 6% generates a larger impact for the imaging cooperative compared to the individually-owned clinic.

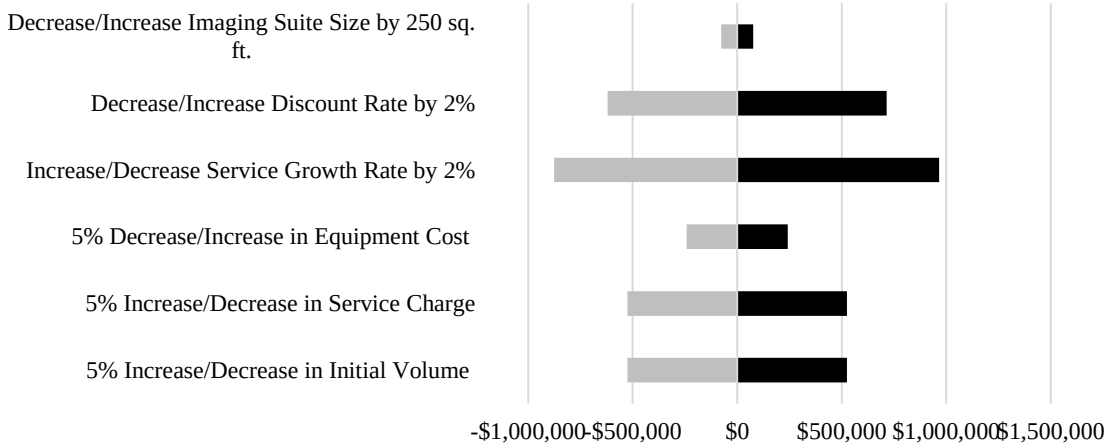

Figure 4.3: Change in Overall Cooperative Return - NPV (Base Estimate = $2,134,278)

Effects of input changes to the imaging cooperative's ROE are shown in Figure 4.4. The most significant positive and negative impacts stem from increasing the 3% growth rate for imaging services to 5% or from decreasing it to 1%. Changes to the interest rate and imaging suite size only slightly affect the cooperative's overall ROE.

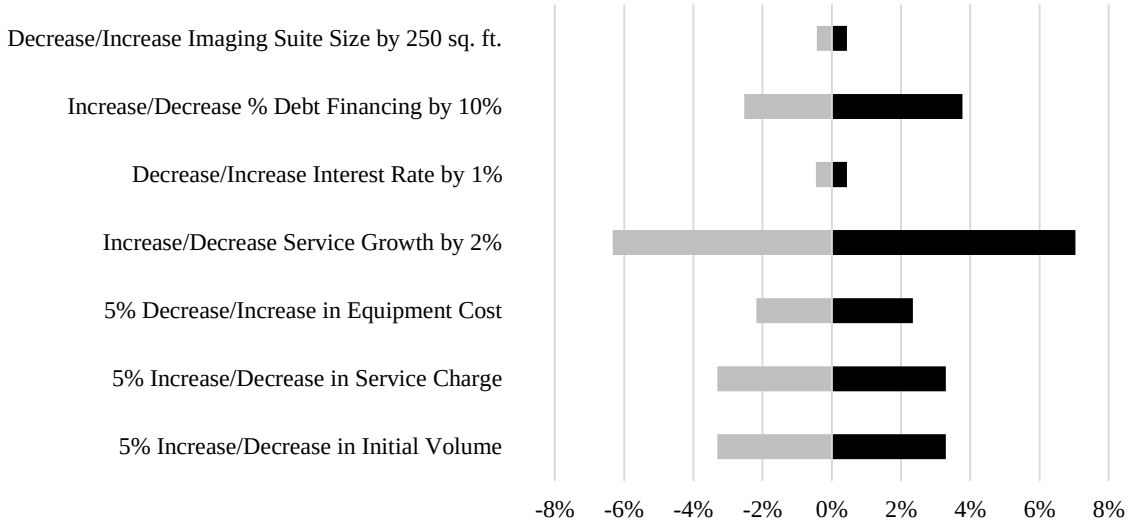

Figure 4.4: Change in Overall Cooperative Return - ROE (Base Estimate = 18.31%)

Sensitivity of Individual Owner Cash Returns

Figure 4.5 shows how the NPV of cash returns to an individual imaging center owner changes when key inputs are varied. Because the equity investment used in NPV analysis is driven by the relative proportions of debt and equity financing, it is no surprise this factor has the greatest impact on projected NPV. Increases and decreases in the growth rate for imaging services also generate a fairly large impact. In contrast, increasing the discount rate from 8% to 10%, or decreasing it to 6% only slightly changes the projected NPV.

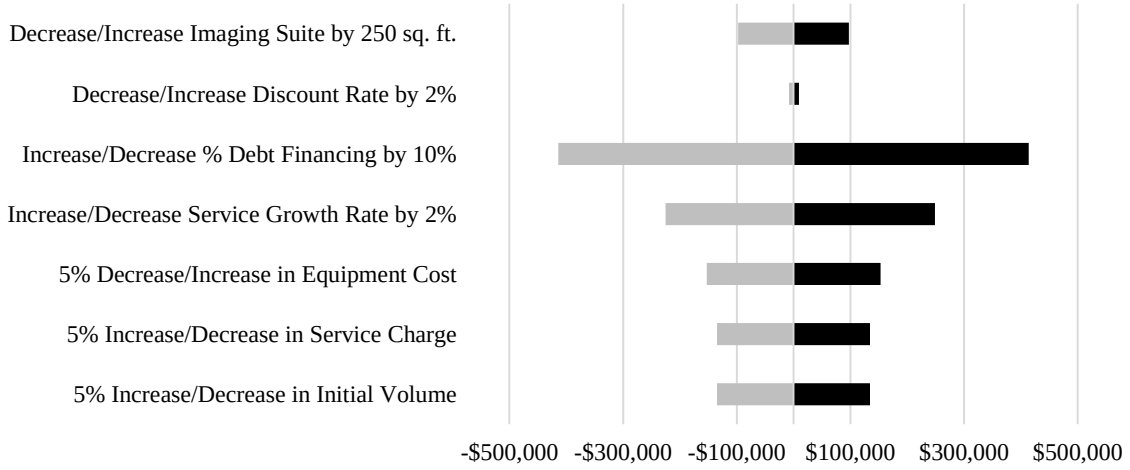

Figure 4.5: Change in Individual Owner Cash Returns – NPV (Base Estimate = -$2,022,369)

Similar to Figure 4.5, Figure 4.6 shows how the cash returns to an individual imaging center owner are affected, but focuses on ROI rather than NPV. The largest changes to ROI stem from increases or decreases to the growth rate for imaging services. Changing the percentage of the investment financed with debt only marginally changed projected ROI for an individual veterinary imaging center owner.

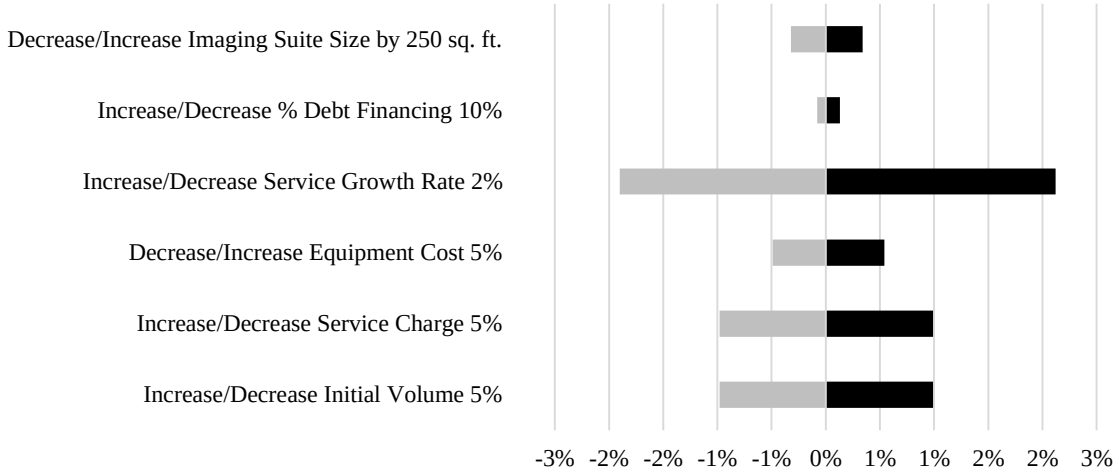

Figure 4.6: Change in Individual Owner Cash Returns - ROI (Base Estimate = 0.48%)

Sensitivity of Cooperative Member Cash Returns

Figure 4.7 focuses on the sensitivity of the projected NPV of cooperative members' individual cash returns. Because the initial investment required for each cooperative member is directly tied to how much of the business is funded with debt relative to equity, projected NPV is highly sensitive to 10% changes in the proportion of the investment funded with debt. Changes in the growth rate for imaging services also have a large impact on projected NPV. Increasing the 3% annual growth rate for imaging services to 5% raises the projected NPV from -$122,267 to $47,832, while decreasing it to 1% reduces the projected NPV to -$276,419.

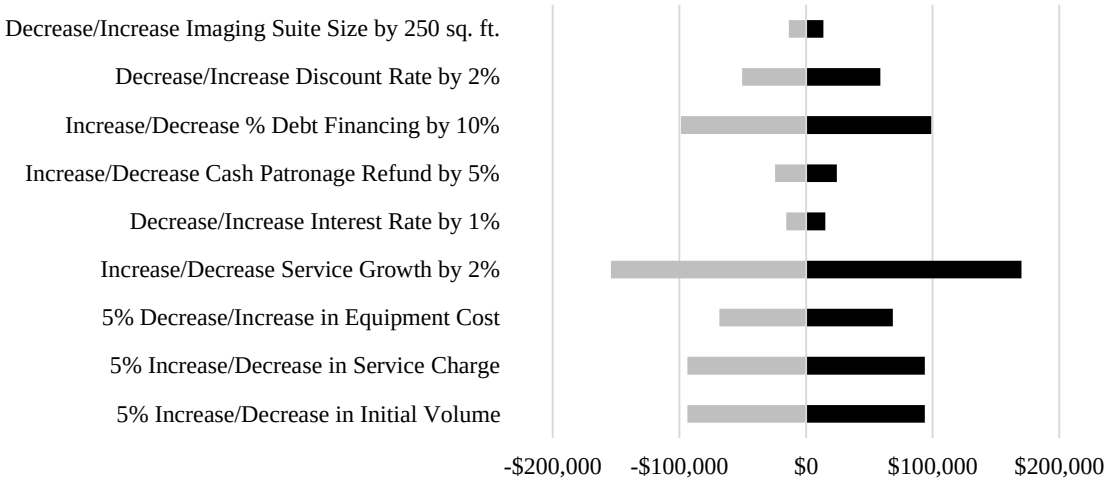

Figure 4.7: Change in Cooperative Member Cash Returns - NPV (Base Estimate = -$122,267)

As was the case with NPV, the ROI of cash returns to cooperative members is also highly sensitive to changes in the growth rate for imaging services (Figure 4.8). Changes to the interest rate and size of the imaging suite cause only minor effects in the projected ROI.

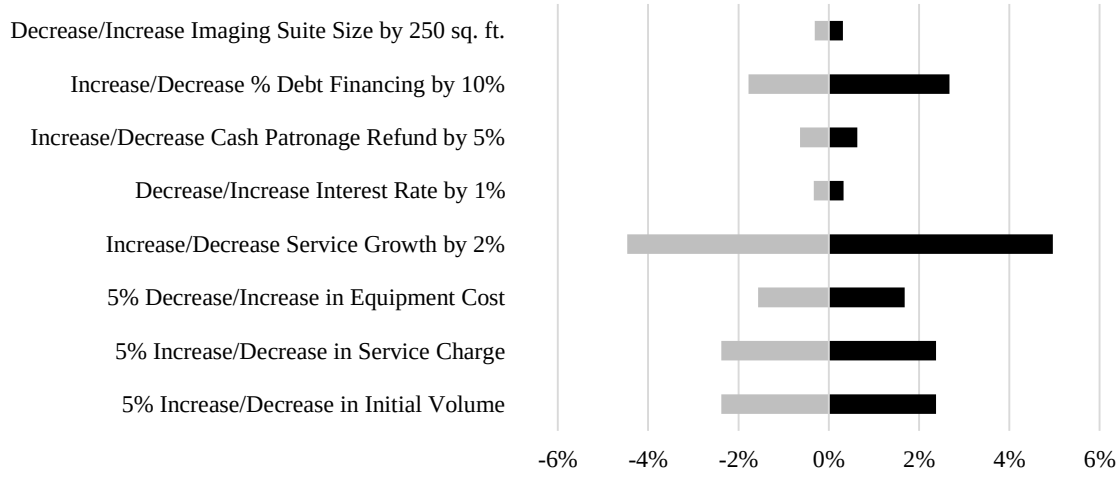

Figure 4.8: Change in Cooperative Member Cash Returns - ROI (Base Estimate = 13.03%)

In summary, the economies of size gained from providing more imaging services using a similar equipment and facility base cause the imaging cooperative to be a far more attractive financial investment compared to an individually-owned imaging center. Under the current set of assumptions, the imaging cooperative has an IRR of 4.15% compared to -33.6% for the

individually-owned scenario. Although the imaging cooperative has a positive IRR, 4.15% is less than the assumed 8% weighted average cost of capital (WACC), resulting in a negative NPV. If a veterinarian was considering expanding to offer imaging services, these results show that sharing facilities and equipment with other veterinarians seems to be a strong possibility to pursue. However, it does not guarantee long-term profitability and each individual situation should be thoroughly analyzed. If demand proved to be sufficient, adding a fifth veterinarian to the four-member cooperative analyzed in this case study would have increased its profitability.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND CONSIDERATIONS FOR FUTURE RESEARCH

Conclusions and Implications

As the veterinary industry experiences consolidation, small and independent veterinarians are increasingly in need of profitable strategies to enable them to compete with larger firms. Little research has been conducted in the field of veterinary economics, especially with regard to applying the cooperative business model to assist veterinarians. The primary objective of this research was to educate veterinarians regarding collaborative equipment cost-sharing efforts, which could increase the profitability of their respective businesses. This was accomplished through the creation of a user-friendly spreadsheet template that can be downloaded by veterinarians and used to assess the feasibility of forming a shared imaging cooperative. In addition, this research displayed the usefulness of the template via a hypothetical scenario comparing a four-veterinarian imaging cooperative to an individually owned veterinary imaging clinic.

The cooperative business model was chosen as the structure under which to form a veterinary imaging center because it has a proven track record of enabling smaller firms to combine resources (Anderson et al. 1995; Crooks, Spatz, and Warman 1997) and it has recently been adapted to the medical industry to share costly equipment and specialty services (Bhuyan 1996; Goldstein 2013). In addition, many veterinarians may not yet understand the mechanics of

the cooperative model, furthering the mission of this research to develop an educational tool. The cooperative corporation has been successfully used in the veterinary medical industry for collective purchasing of inputs but could also benefit veterinarian members of shared services entities by providing mechanisms for distributing earnings, replacing equipment, and revolving equity in order to allow for easier member transitions. Given the structural similarities between the human medical and veterinary industries, and increased use of cooperatives in human medicine, it seems the cooperative model could potentially be adapted to the veterinary sector to enable veterinarians to share equipment and services.

RSMeans construction data was utilized to program the spreadsheet template to estimate the cost to build a veterinary imaging center and stock it with imaging equipment. Other construction and equipment data was taken from the Predesign Report for the University of Minnesota Veterinary Imaging Center (2007). For purposes of comparison, it was assumed an individual owner of a veterinary imaging center would choose to add-on to his or her existing clinic for both economic and geographic reasons. To avoid favoring any one cooperative member by locating the imaging center on their premises, the hypothetical case assumed an imaging cooperative should be constructed new as opposed to adding to an existing clinic. The three types of services provided by the imaging clinics in this hypothetical case study include MRI, X-ray, and dental imaging for dogs, cats, and horses. Service charges to customers and associated initial volumes for these services were estimated using data from the 2012 AVMA Pet Demographic Survey and the Predesign Report for the University of Minnesota Veterinary Imaging Center (2007).

The base estimates in the spreadsheet template are such to create a case study scenario comparing the profitability of an individually-owned imaging center to a four-veterinarian imaging cooperative. Given the anticipated set of assumptions, the projected initial investment required for an individual owner of a veterinary imaging center includes $737,933 for the facility expansion and $3,403,102 in equipment. In comparison, because of the additional cost to

construct a new facility and the cost for extra equipment to support four veterinarians, the required initial investment for an imaging cooperative includes $1,267,754 for construction and $3,560,961 for equipment. Because of the large initial investment required and fewer imaging services performed compared to the cooperative imaging clinic, the individually-owned imaging clinic is projected to generate a loss each of the 10 years projected. In order to break even during the first year, the individually-owned veterinary imaging center would need to provide roughly three times as many imaging services compared to the base scenario. Taking advantage of economies of size and spreading the equipment and facility investment across four veterinarians, the cooperative imaging center is projected to generate a profit each of the 10 years projected.

Depreciation on buildings and equipment ranks as the largest expense category for both the individual and cooperative scenarios, and accounts for roughly 40% of projected total expenses for each ownership strategy. If idle machine time exists, it makes an imaging center an ideal opportunity for collaboration in order to divide these fixed costs among multiple practice owners. One unique aspect of the cooperative business is for members to grow equity in the business through stock patronage refunds. Over the course of the 10-year projection period, the total members' equity invested in the cooperative grows from $2.41 million to $2.98 million, or roughly $141,000 in value for each member.

Under the assumed combination of inputs for the case study and 10-year projection period, investment in an individually-owned veterinary imaging clinic has a net present value (NPV) of -$4,092,886 and an internal rate of return (IRR) of -33.87%. In comparison, taking advantage of the additional revenue from four veterinarians providing imaging services, investment in a cooperative veterinary imaging clinic generates a 10-year NPV of $2,134,278 and IRR of 16.46%. With the given set of assumptions, it is evident the cooperative imaging center is substantially more profitable than the individually-owned imaging center. This is unsurprising, however, because the cooperative imaging center generates four times as much gross margin compared to the individual clinic, but has only slightly higher fixed expenses.

Based on their initial cash investment, equal to 25% of the total cooperative investment in property, plant, and equipment, cooperative members are projected to receive a 13.03% average ROI and IRR of 4.15%. Comparatively, an individual owner of a veterinary imaging center is only projected to receive an average ROI of 0.48% and can expect an IRR of -33.60%.

Key inputs were varied to test the sensitivity of their impact on profitability measures. It is difficult to make comparisons of which changes had the most impact because inputs were not varied by a set, consistent proportion. Increasing the 3% growth rate for imaging services to 5%, or decreasing it to 1% generated a large impact on profitability in most cases. However, depending on the measure being tested, changes to the long-term interest rate, discount rate, and percent of investment financed with debt also have a substantial impact on profitability measures. The flexibility within the spreadsheet template allows for a wide array of service options and scenarios to be considered. Overall, given the results of the case study, it can be concluded that under the assumed input structure, a shared veterinary imaging center under the cooperative structure is projected to be more profitable than an imaging center owned by an individual veterinarian.

Limitations of this Study

This study has resulted in the creation of a comprehensive model for evaluating a veterinary imaging center as both a cooperative comprised of multiple veterinarians and as an individually-owned clinic. While the spreadsheet model was created to allow for flexibility, there are obvious limitations with regard to some of the assumptions in the case study example provided. For example, as it was previously stated, the cost data used to estimate the variable expenses for providing imaging services likely included factors accounted for other places in the spreadsheet, resulting in overstated variable expenses. In addition, no consideration was taken to whether or not imaging service demand would be sufficient for the cooperative to provide four times as many services as the individual clinic. Ideally, considerable market research would be

conducted in order to more realistically estimate the number of imaging services that could be provided.

This study is also limited in the fact that each veterinarian in the cooperative is assumed to provide an equal number of services at an equal price, resulting in each being an equal 25% owner. Along those same lines, cooperative investment is divided among members based on the projected gross margin from imaging services each veterinarian provides. While this might be sufficient to make financial projections, it does not provide any mechanisms to account for veterinarians who provide either more or fewer services than anticipated. Therefore, this template is not useful as an accounting tool. Also related to the imaging cooperative, only nonqualified common stock was considered. Many cooperatives also distribute qualified stock in addition to nonqualified stock. In order to make the cooperative functions as easy to understand as possible, especially for veterinarians who may not be familiar with the cooperative structure, qualified stock was excluded from this study.

With regard to the sensitivity of key input variables, most inputs were varied by an arbitrary percentage or amount. Without a more complete set of data, it was not possible to place distributions on input values in order to constitute a thorough sensitivity analysis.

One final limitation is many of the sources used to estimate inputs for the case study scenarios were dated to an extent, some in the amount of 5-10 years. While values used in the template were adjusted using CPI indexes to account for inflation, more recent data would have likely provided better estimates for the case study examples. Even though more precise data would have likely led to more accurate projections, the estimated inputs in the spreadsheet template adequately served the purpose of being able to compare an individually-owned veterinary imaging center to a four-veterinarian imaging cooperative.

Considerations for Future Research

Better data for imaging service charges, variable expenses for providing imaging services, and the demand for veterinary imaging services could drastically improve the accuracy

of financial projections. In addition, detailed data could have provided distributions for each variable, as opposed to the single estimated value for each spreadsheet input currently used. This would have allowed simulation analysis to be performed. Detailed simulations would permit future researchers to estimate the probability of returns to individual and cooperative owners. Nonetheless, the spreadsheet template serves as a model that can be modified or built upon to improve its accuracy.

Veterinarians in a geographic area would likely compete more closely than, for example, farmer members in an agricultural cooperative. Future research is needed to better understand the interpersonal competition that veterinarian members would experience in a shared imaging cooperative. It is currently unclear whether or not veterinarians would be willing to forego their competitive tendencies in order to collaborate with other veterinarians by sharing equipment and providing additional services.

This research revolved around the creation of a hypothetical case study to illustrate how sharing costly equipment using the cooperative model could benefit veterinarians. While the cooperative model may offer unique benefits to veterinarians, other legal structures such as the LLC, partnership, and others could be used by veterinarians to form a shared imaging center. Future research could examine the potential for a shared veterinary imaging center to be organized under other legal structures and compare to a cooperative structure. The scope of this study does not include an examination of how an imaging cooperative would be formed and structured. For those desiring to start an imaging cooperative, the following publications would likely be of assistance in the beginning stages.

1. "Basics of Organizing a Shared-Services Cooperative" (Crooks, Spatz, and Warman 1995). https://www.rd.usda.gov/files/SR46.pdf
2. "Organizing a Machinery Cooperative" (Kenkel and Long 2007). http://www.agecon.okstate.edu/coops/files/Organizing%20a%20Machinery%20Cooperative.pdf

3. “Steps for Start-Ups” (University of Wisconsin Center for Cooperatives). http://www.uwcc.wisc.edu/howtostart/Steps/
    a. UWCC also has a list of cooperative start-up resources http://www.uwcc.wisc.edu/howtostart/Resources/

Furthermore, this study serves as a model that can be adapted and altered to fit a variety of situations. Imaging equipment and services were analyzed in this case study example, but the idea of veterinarians collaborating to share equipment and services could be applied to laboratory, neurology, ambulatory, and/or other specialty services. Future researchers could adapt this model to a number of veterinary issues, or even apply it beyond the veterinary industry.

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APPENDICES

Spreadsheet Images

The images on the following pages are included to allow readers to visualize the spreadsheet template developed through this research effort. Values in the images represent base values for the case study example. Cells shaded in blue can be modified by spreadsheet users in order to adapt it to a variety of situations.

Tab 1: Individual Inputs Sheet

Individual Inputs									
Percent Financed	50%								
Long Term Interest Rate	7.50%								
Loan Term	7								
Total Plant Property & Equip	$4,141,035								
Loan Amount	$2,070,517								
Working Capital Needed	$0								
Short Term Interest Rate	4.50%								
Discount rate for NPV calculation	8%								
Tax Information									
Property Tax as % of Prop and Plant	0.50%								
Income Tax Rate	20.00%								
Utilities									
Electricity/month	$1,000.00								
Water/month	$250.00								
Gas/month	$1,000.00								
Telephone/month	$200.00								
Total Utilities/Month	$2,450.00								

Type of Service Offered	Price Charged to Customer	Initial Volume	Annual Growth Rate	Variable Expenses for Supplies, etc. (NOT equipment
3T Dog MRI Scan	$1,158	121	3.00%	$93.26
3T Cat MRI Scan	$1,158	70	3.00%	$93.26
3T Horse MRI Scan	$1,852	33	3.00%	$149.21
Cat Dental Imaging	$281	25	3.00%	$37.71
Dog X-Ray	$178	50	3.00%	$23.91
Cat X-Ray	$158	23	3.00%	$21.21
Dog Dental Imaging	$247	62	3.00%	$33.12
Horse X-Ray	$261	90	3.00%	$35.06
Horse Dental Imaging	$152	351	3.00%	$20.36
	$0	0		$0.00

NOTE: Selected equipment should match the types of services provided. For example, if 1.5T MRI services are offered, a 1.5T MRI scanner should be selected on the Depreciation sheet. If dental imaging services are provided, a dental x-ray scanner and support equipment should be selected

Other		
Expense Inflation Rate (%)	2.00%	
Maintenance as % of Plant & Equip	3.00%	
Insurance as % of Plant & Equip	2.00%	
Equipment Reinvestment Percentage	14.30%	Must be at least 14.3% to accumulate enough to replace equipment as it is used up

Tab 1: Individual Inputs Sheet (cont.)

Building Space Needed				
Please choose one of the following options below:				
Add-On Imaging Suite to Current Clinic				
Add-On Imaging Suite to Current Clinic			**Default Estimates**	
Imaging Suite	$434.08	per sq. ft.	$434.08	Average estimate from Junk and Gilk (2007) adjusted for inflation to 2016
Support Space	$202.57	per sq. ft.	$202.57	Average estimate from Junk and Gilk (2007) adjusted for inflation to 2016
Square feet needed for imaging suite	1,000			
Square feet needed for support space (waiting room(s), office space, restrooms, etc.)	1,500			
Total Cost of Expansion	$737,933			
Face Brick & Concrete Block / Wood Truss				
	7,500			
	25.00%			
	9.00%			
	0.00%			

Tab 1: Individual Inputs Sheet (cont.)

Personnel Needs									
Total Personnel Cost	**$107,279.69**								
Payroll Information									
% of Payroll Tax to Salaries	5.00%								
% of Retirement Tax to Salaries	15.00%								
% of Employee INS Tax to Salaries	10.00%								
Total Benefits as % of Salaries	30.00%								
Wage Inflation	2.00%								
Salary Employees									
Occupation	**Number of Employees**	**Salary**	**Total Salary**	**Benefits**	**Total Salary**				
Imaging Technician	1	$58,120	$58,120	$17,436	$75,556				
Total Salary Cost					**$75,556**				
Hourly Employees									
Occupation	**Number of Employees**	**Wage Rate ($/hr.)**	**Hours/week**	**Base Pay**	**Benefits**	**Overtime %**	**Overtime Pay**	**Total Wages**	
Vet Tech	1	$15.29	30	$23,852	$7,156	3.00%	$716	$31,724	
						0.00%			
Total Wage Cost								**$31,724**	

Tab 2: Individual Depreciation and Amortization Sheet

This sheet calculates depreciation. You enter descriptions and values for buildings, equipment and other property.

Depreciation	
Buildings	39 year Straight Line
Special Purpose Buildings	10 year Straight Line
Equipment and Heavy Rolling Stock	7 year Straight Line with Additional Reinvestment for Replacement
Light Trucks and Vehicles	5 Yr MACRS with half year convention

Buildings	**Description**	**Cost**
Add-On Imaging Suite to Current Clinic	Renovations/Improvements	$737,933
Total Buildings		$737,933

Equipment and Heavy Rolling Stock	**Unit Cost**	**Quantity**	**Total Cost**
MRI Scanner Unit (3T)	$2,819,199	1	$2,819,199
MRI-compatible monitoring equipment (large & small animal)	$66,559	1	$66,559
MRI-compatible Injector for contrast (large & small animal)	$43,408	1	$43,408
MRI Large Animal Anesthesia Machine	$86,816	1	$86,816
MRI Small Animal Anesthesia Machine	$40,514	1	$40,514
MRI Equine table	$46,302	1	$46,302
Stationary X-Ray Unit	$142,950	1	$142,950
X-Ray Developing Processors	$9,263	1	$9,263
Panoramic Dental X-Ray Unit	$34,490	1	$34,490
Dental X-Ray Developers	$8,140	1	$8,140
Anesthesia Monitoring Equipment	$10,418	1	$10,418
Major Surgery Table	$36,347	2	$72,694
Overhead, 4-post lift (1,000 lb. capacity)	$11,300	1	$11,300
Overhead lift, track type (450 lb. capacity)	$3,725	1	$3,725
Kennel Doors (each)	$218	4	$871
Kennel Fencing (1-1/2" mesh, 12' long, 3' - 6" wide, 6 - 2" tall)	$960	2	$1,921
Kennel Fencing Top Cover (1-1/2" mesh, 12' long)	$272	2	$543
Kennel Fencing Top Cover (1-1/2" mesh, 6' long)	$201	4	$802
Surveillance Camera and Monitor	$2,071	1	$2,071
For each additional security camera, must alreadt have camera & monitor	$1,119	1	$1,119
			$0
			$0
			$0
			$0
			$0
Total Equipment & Heavy Rolling Stock			3,403,102

Tab 2: Individual Depreciation and Amortization Sheet (cont.)

Special Purpose Buildings	Description	Cost
Total Special Purpose Buildings		$0

Light Trucks and Vehicles	Description	Cost
Total Light Trucks and Vehicles		$0

5-Year MACRS w/half-year conv. For Light Trucks and Vehicles		
Year	Depreciation	Rate
1	$0	20.00%
2	$0	32.00%
3	$0	19.20%
4	$0	11.52%
5	$0	11.52%
6	$0	5.76%

Equipment and Heavy Rolling Stock	1	2	3	4	5	6	7	8	9	10
Beginning Balance	$3,403,102	$2,917,431	$2,917,778	$2,918,076	$2,918,331	$2,918,550	$2,918,737	$2,918,898	$2,919,035	$2,919,153
Reinvestment	$486,644	$486,644	$486,644	$486,644	$486,644	$486,644	$486,644	$486,644	$486,644	$486,644
Net Equipment Balance	$3,403,588	$3,404,075	$3,404,422	$3,404,719	$3,404,975	$3,405,193	$3,405,381	$3,405,541	$3,405,679	$3,405,797
Depreciation	**$486,157.46**	**$486,296**	**$486,346**	**$486,388**	**$486,425**	**$486,456**	**$486,483**	**$486,506**	**$486,526**	**$486,542**

REMINDER: Equipment must be purchased in order to provide certain services. For example an MRI scanner and support equipment must be purchased in order to provide MRI services, dental x
scanners and processors must be purchased in order to provide dental imaging servics, and so on.

Tab 2: Individual Depreciation and Amortization Sheet (cont.)

Annual Total Depreciation					
Year	**1**	**2**	**3**	**4**	**5**
Buildings	$18,921	$18,921	$18,921	$18,921	$18,921
Equipment and Heavy Rolling Stock	$486,157	$486,296	$486,346	$486,388	$486,425
Light Trucks and Vehicles	$0	$0	$0	$0	$0
Special Purpose Buildings	$0	$0	$0	$0	$0
Total Depreciation	$505,079	$505,218	$505,267	$505,310	$505,346

Annual Total Depreciation					
Year	**6**	**7**	**8**	**9**	**10**
Buildings	$18,921	$18,921	$18,921	$18,921	$18,921
Equipment and Heavy Rolling Stock	$486,456	$486,483	$486,506	$486,526	$486,542
Light Trucks and Vehicles	$0				
Special Purpose Buildings	$0	$0	$0	$0	$0
Total Depreciation	$505,378	$505,404	$505,427	$505,447	$505,464

Tab 2: Individual Depreciation and Amortization Sheet (cont.)

					Loan Amortization for Individual Expansion					
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Beginning Balance	$2,070,517	$1,834,892	$1,581,594	$1,309,300	$1,016,583	$701,912	$363,641	$0	$0	$0
Interest Rate	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	0.00%	0.00%	0.00%
Interest	$155,289	$137,617	$118,620	$98,197	$76,244	$52,643	$27,273	$0	$0	$0
Annual Payment	$390,914	$390,914	$390,914	$390,914	$390,914	$390,914	$390,914	$0	$0	$0
Principal	$235,626	$253,297	$272,295	$292,717	$314,671	$338,271	$363,641	$0	$0	$0
Ending Balance	$1,834,892	$1,581,594	$1,309,300	$1,016,583	$701,912	$363,641	$0	$0	$0	$0
Total Interest Expense	$155,289	$137,617	$118,620	$98,197	$76,244	$52,643	$27,273	$0	$0	$0
Accumulated Interest Expense	$155,289	$292,906	$411,525	$509,723	$585,966	$638,610	$665,883	$665,883	$665,883	$665,883

Tab 3: Individual Summary Sheet

	Year	0	1	2	3	4	5
3T Dog MRI Scan			$139,875	$144,071	$148,393	$152,845	$157,430
3T Cat MRI Scan			$81,256	$83,694	$86,205	$88,791	$91,454
3T Horse MRI Scan			$60,192	$61,998	$63,858	$65,774	$67,747
Cat Dental Imaging			$6,931	$7,139	$7,353	$7,573	$7,801
Dog X-Ray			$8,861	$9,127	$9,400	$9,682	$9,973
Cat X-Ray			$3,706	$3,817	$3,931	$4,049	$4,171
Dog Dental Imaging			$15,249	$15,707	$16,178	$16,663	$17,163
Horse X-Ray			$23,414	$24,116	$24,840	$25,585	$26,353
Horse Dental Imaging			$53,293	$54,891	$56,538	$58,234	$59,981
			$0	$0	$0	$0	$0
Less: Variable Costs for Providing Imaging Services			$37,616	$38,368	$39,136	$39,919	$40,717
Gross Margin - Veterinary Imaging Services		**$0**	**$355,159**	**$366,190**	**$377,560**	**$389,278**	**$401,355**
Less: Personnel Expense for Salary Employees			$75,556	$77,067	$78,608	$80,181	$81,784
Less: Personnel Expense for Hourly Employees			$31,724	$32,358	$33,005	$33,665	$34,339
Less: Depreciation on Buildings and Equipment			$505,079	$505,218	$505,267	$505,310	$505,346
Less: Maintenance Expenses			$124,231	$126,716	$129,250	$131,835	$134,472
Less: Insurance Expenses			$82,821	$84,477	$86,167	$87,890	$89,648
Less: Property Tax			$20,705	$21,119	$21,542	$21,972	$22,412
Less: Interest Expense			$155,289	$137,617	$118,620	$98,197	$76,244
Less: Utility Expenses			$29,400	$29,988	$30,588	$31,200	$31,824
Less: Miscellaneous Supplies Expenses				$0	$0	$0	$0
Less: Other Miscellaneous Expenses				$0	$0	$0	$0
Total Veterinary Imaging Service Expenses		**$0**	**$1,024,804**	**$1,014,560**	**$1,003,047**	**$990,250**	**$976,068**
Pretax Income			-$669,645	-$648,370	-$625,487	-$600,972	-$574,712
Income Tax Paid			$0	$0	$0	$0	$0
After Tax Income		**$0**	**-$669,645**	**-$648,370**	**-$625,487**	**-$600,972**	**-$574,712**

Tab 3: Individual Summary Sheet (cont.)

Approximate Cash Flow	Year	0	1	2	3	4	5
Cash Flows From Operations							
Beginning Balance			$0	-$164,566	-$307,718	-$427,937	-$523,600
Add: Net Income			-$669,645	-$648,370	-$625,487	-$600,972	-$574,712
Add: Depreciation			$505,079	$505,218	$505,267	$505,310	$505,346
Net Operating Cash Flow			-$164,566	-$143,152	-$120,220	-$95,663	-$69,366
Cummulative Operating Cash Flow			-$164,566	-$307,718	-$427,937	-$523,600	-$592,966
Cash Flows From Investing and Financing							
Beginning Balance		$0	$0	-$722,269	-$1,462,210	-$2,221,149	-$3,000,509
Add: Loans Received		$2,070,517					
Less: Equipment and Buildings Purchased		$2,070,517	$486,644	$486,644	$486,644	$486,644	$486,644
Less: Loan Principal Paid			$235,626	$253,297	$272,295	$292,717	$314,671
Net Investing and Financing Cash Flow		$0	-$722,269	-$1,462,210	-$2,221,149	-$3,000,509	-$3,801,823
Net Annual Cash Flow		$0	-$886,835	-$883,093	-$879,158	-$875,023	-$870,680
Net Cummulative Cash Flow		$0	-$886,835	-$1,605,362	-$2,341,368	-$3,096,172	-$3,871,189

Tab 4: Cooperative Input Sheet

Input, Capital Structure, and Expense Information			**Utilities**	
Percent Financed	50%		Electricity/month	$1,000.00
Long Term Interest Rate	7.50%		Water/month	$250.00
Loan Term (Years)	7		Gas/month	$1,000.00
Total Plant Property & Equip	$4,828,715		Telephone/month	$200.00
Loan Amount	$2,414,358		**Total Utilities/Month**	$2,450.00
Working Capital Needed	$0			
Short Term Interest Rate	4.50%		**Profit Allocation**	
Discount rate for NPV calculation	8%		(all percentages relate to pre-tax income)	
			Percentage to Cash Patronage Refund	85%
Expenses and Fees			Percentage to Stock Patronage Refund	10%
Expense Inflation Rate	2%		Percentage to Unallocated	5%
Maintenance as % of Plant & Equip	3%		Cash, Stock, and Unallocated should add up to 100%	100%
Insurance as % of Plant & Equip	2%		Percent Member Business	100%
			Other	
Co-op Financing Inputs			Equipment Reinvestment Percentage	14.3%
Membership Common Stock	$2,414,358			
Is Common Stock Tradeable? (answer from dropdown)	No			
Revolving Period (years)	7		**Tax Information**	
Preferred Stock	$0		Property Tax as % of Prop and Plant	0.50%
Dividend Rate on Preferred Stock	12.00%		Income Tax Rate	20.00%
			Co-op members' Individual tax rate	20.00%

Tab 4: Cooperative Input Sheet (cont.)

	Veterinarian	Veterinarian	Veterinarian	Veterinarian
Producer/Member Description	**1**	**2**	**3**	**4**
Average Revenue Per Member	$450,273	$450,273	$450,273	$450,273
Share of Veterinary Imaging Cooperative	25%	25%	25%	25%
Required Investment in Cooperative	$603,589	$603,589.42	$603,589	$603,589
Veterinarian 1				
Type of Service Offered	**Price Charged to Customer**	**Initial Service Volume**	**Annual Growth Rate (%)**	**Variable Expense for Supplies, etc. (NOT equipment or personnel)**
3T Dog MRI Scan	$1,158	121	3.00%	$93.26
3T Cat MRI Scan	$1,158	70	3.00%	$93.26
Dog Dental Imaging	$247	62	3.00%	$33.12
Cat Dental Imaging	$281	25	3.00%	$37.71
Dog X-Ray	$178	50	3.00%	$23.91
Cat X-Ray	$158	23	3.00%	$21.21
Horse X-Ray	$261	90	3.00%	$35.06
3T Horse MRI Scan	$1,852	33	3.00%	$149.21
Horse Dental Imaging	$152	351	3.00%	$20.36
	$0	0		$0.00

Note: The spreadsheet template contains a separate service input table for each veterinarian member. Only the table for Veterinarian 1 is shown.

Tab 4: Cooperative Input Sheet (cont.)

Choose to Either Construct or Lease an Imaging Suite		
Construction of a New Imaging Suite		
Construction of a New Imaging Suite		
Choose Wall/Framing Type	**Cost/Sq. ft.**	
Face Brick & Concrete Block / Wood Truss	$128.56	
Building Area (sq. ft.) Including Imaging Proportion	5,500.00	$707,080
Contractor Fees	25.00%	$176,770
Architectural Fees	9.00%	$79,547
User Fees (%)	0.00%	$0
Base Building Construction Cost		$963,397
Add: Radio-Frequency Shielding		
Imaging Space Area (Sq. Ft.)	1,240.00	
Imaging Space Perimeter (Ft.)	142.00	
Imaging Space Ceiling Height (Ft.)	12.00	
If MRI Services are Offered, Choose Additional Construction for RF-Shielding	**Unit Cost**	**Total Cost**
X-Ray Concrete Slabs (per sq. ft.)	$200.00	$248,000
Prefabricated RF-Shielded Ceiling Panel, 5 oz. copper (per sq. ft. surf.)	$12.73	$15,785
Prefabricated RF-Shielded Floor Panel, 5 oz. copper (per sq. ft. surf.)	$7.44	$9,226
Prefabricated RF-Shielded Wall Panel, 5 oz. copper (per sq. ft. surf.)	$12.73	$21,692
RF Shielded Door	$9,655.00	$9,655
Total Additional Costs for RF-Shielding		$304,358
Total Imaging Suite Construction Cost		**$1,267,754**

Tab 4: Cooperative Input Sheet (cont.)

Personnel Needs								
Total Personnel Cost	**$217,308.00**							
Payroll Information								
% of Payroll Tax to Salaries	5.00%							
% of Retirement Tax to Salaries	15.00%							
% of Employee INS Tax to Salaries	10.00%							
Total Benefits as % of Salaries	30.00%							
Wage Inflation	2.00%							
Salary Employees								
Occupation	**Number of Employees**	**Salary**	**Total Salary**	**Benefits**	**Total Salary**			
Imaging Technician	1	$58,120	$58,120	$17,436	$75,556			
Receptionist	1	$27,300	$27,300	$8,190	$35,490			
Total Salary Cost					$111,046			
Hourly Employees								
Occupation	**Number of Employees**	**Wage Rate ($/h**	**Hours/week**	**Base Pay**	**Benefits**	**Overtime %**	**Overtime Pay**	**Total Wages**
Vet Techs	1	$15.29	40	$31,803	$9,540.96	5.00%	$1,590	$42,934
Veterinary Assistant	2	$11.71	40	$48,714	$14,614.08	0.00%	$0	$63,328
Total Wage Cost								$106,262

Tab 5: Cooperative Depreciation and Amortization

This sheet calculates depreciation. You enter descriptions and values for buildings, equipment and other property.			
Depreciation			
Buildings	39 year Straight Line		
Special Purpose Buildings	10 year Straight Line		
Equipment and Heavy Rolling Stock	7 Yr MACRS with half year convention		
Light Trucks and Vehicles	5 Yr MACRS with half year convention		
Buildings	**Description**	**Cost**	
Construction of a New Imaging Suite	Cost to Construct New Building	$1,267,754.22	
Total Buildings		$1,267,754.22	
Equipment and Heavy Rolling Stock	**Cost/Unit**	**Quantity**	**Total Cost**
MRI Scanner Unit (3T)	$2,819,199	1	$2,819,199
MRI-compatible monitoring equipment (large & small animal)	$66,559	1	$66,559
MRI-compatible Injector for contrast (large & small animal)	$43,408	1	$43,408
MRI Large Animal Anesthesia Machine	$86,816	1	$86,816
MRI Small Animal Anesthesia Machine	$40,514	3	$121,542
MRI Equine table	$46,302	1	$46,302
Stationary X-Ray Unit	$142,950	1	$142,950
X-Ray Developing Processors	$9,263	1	$9,263
Panoramic Dental X-Ray Unit	$34,490	1	$34,490
Dental X-Ray Developers	$8,140	1	$8,140
Anesthesia Monitoring Equipment	$10,418	1	$10,418
Major Surgery Table	$36,347	4	$145,387
Overhead, 4-post lift (1,000 lb. capacity)	$11,300	1	$11,300
Overhead lift, track type (450 lb. capacity)	$3,725	1	$3,725
Kennel Doors (each)	$218	8	$1,742
Kennel Fencing (1-1/2" mesh, 12' long, 3' - 6" wide, 6 - 2" tall)	$960	4	$3,842
Kennel Fencing Top Cover (1-1/2" mesh, 12' long)	$272	4	$1,087
Kennel Fencing Top Cover (1-1/2" mesh, 6' long)	$201	8	$1,604
Surveillance Camera and Monitor	$2,071	1	$2,071
For each additional security camera, must alreadt have camera & monitor	$1,119	1	$1,119
			$0
			$0
			$0
			$0
			$0
Total Equipment & Heavy Rolling Stock			$3,560,961

Tab 5: Cooperative Depreciation and Amortization

Special Purpose Buildings	Description	Cost
Total Special Purpose Buildings		$0

Light Trucks and Vehicles	Description	Cost
Total Light Trucks and Vehicles		$0

5-Year MACRS w/half-year conv. For Light Trucks and Vehicles		
Year	Depreciation	Rate
1	$0	20.00%
2	$0	32.00%
3	$0	19.20%
4	$0	11.52%
5	$0	11.52%
6	$0	5.76%

Equipment and Heavy Rolling Stock	1	2	3	4	5	6	7	8	9	10
Beginning Balance	$3,560,961	$3,052,761	$3,053,124	$3,053,436	$3,053,703	$3,053,932	$3,054,128	$3,054,296	$3,054,440	$3,054,564
Reinvestment	$509,217.44	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217
Net Balance	$3,561,470	$3,561,979	$3,562,342	$3,562,653	$3,562,920	$3,563,149	$3,563,345	$3,563,513	$3,563,657	$3,563,781
Depreciation	**$508,708.73**	**$508,854.08**	**$508,905.98**	**$508,950.48**	**$508,988.62**	**$509,021.30**	**$509,049.32**	**$509,073.34**	**$509,093.93**	**$509,111.57**

REMINDER: Equipment must be purchased in order to provide certain services. For example an MRI scanner and support equipment must be purchased in order to provide MRI services, dental x-ray scanners and processors must be purchased in order to provide dental imaging servics, and so on.

Tab 5: Cooperative Depreciation and Amortization

Annual Total Depreciation					
Year	**1**	**2**	**3**	**4**	**5**
Buildings	$32,507	$32,507	$32,507	$32,507	$32,507
Equipment and Heavy Rolling Stock	$508,709	$508,854	$508,906	$508,950	$508,989
Light Trucks and Vehicles	$0	$0	$0	$0	$0
Special Purpose Buildings	$0	$0	$0	$0	$0
Total Depreciation	$541,215	$541,361	$541,413	$541,457	$541,495

Annual Total Depreciation					
Year	**6**	**7**	**8**	**9**	**10**
Buildings	$32,507	$32,507	$32,507	$32,507	$32,507
Equipment and Heavy Rolling Stock	$509,021	$509,049	$509,073	$509,094	$509,112
Light Trucks and Vehicles	$0				
Special Purpose Buildings	$0	$0	$0	$0	$0
Total Depreciation	$541,528	$541,556	$541,580	$541,600	$541,618

Tab 5: Cooperative Depreciation and Amortization

Summary of Cooperative Financing										
Total Investment	$4,828,715									
Long-Term Interest Rate	7.50%									
Percent Financed	50.00%									
Loan Amount	$2,414,358									
Loan Term (Years)	7									
Working Capital Loan	$0									
Short-Term Interest Rate	4.50%									
Working Capital Loan Interest	$0									
				Imaging Cooperative Loan Amortization						
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Beginning Balance	$2,414,358	$2,139,603	$1,844,242	$1,526,728	$1,185,402	$818,475	$424,029	$0	$0	$0
Interest Rate	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	0.00%	0.00%	0.00%
Interest	$181,077	$160,470	$138,318	$114,505	$88,905	$61,386	$31,802	$0	$0	$0
Annual Payment	$455,831	$455,831	$455,831	$455,831	$455,831	$455,831	$455,831	$0	$0	$0
Principal	$274,755	$295,361	$317,513	$341,327	$366,926	$394,446	$424,029	$0	$0	$0
Ending Balance	$2,139,603	$1,844,242	$1,526,728	$1,185,402	$818,475	$424,029	$0	$0	$0	$0
Total Interest Expense	$181,077	$160,470	$138,318	$114,505	$88,905	$61,386	$31,802	$0	$0	$0
Accumulated Interest Expense	$181,077	$341,547	$479,865	$594,370	$683,275	$744,661	$776,463	$776,463	$776,463	$776,463

Tab 6: Cooperative Summary

	Year	0	1	2	3	4	5	6	7	8	9	10
Veterinary Imaging Service Revenue		$0	$1,571,102	$1,618,235	$1,666,782	$1,716,786	$1,768,290	$1,821,338	$1,875,978	$1,932,258	$1,990,225	$2,049,932
Variable Expenses for Providing Imaging Services		$0	$150,465	$153,474	$156,543	$159,674	$162,868	$166,125	$169,448	$172,836	$176,293	$179,819
Gross Margin-Veterinary Imaging Services		**$0**	**$1,420,638**	**$1,464,762**	**$1,510,239**	**$1,557,112**	**$1,605,422**	**$1,655,213**	**$1,706,531**	**$1,759,421**	**$1,813,932**	**$1,870,113**
Personnel Expenses for Hourly Employees			$106,262	$110,555	$112,766	$115,021	$117,322	$119,668	$122,062	$124,503	$126,993	$129,533
Personnel Expenses for Salary Employees			$111,046	$113,267	$115,532	$117,843	$120,200	$122,604	$125,056	$127,557	$130,108	$132,710
Total Personnel Expenses			$217,308	$223,822	$228,298	$232,864	$237,522	$242,272	$247,117	$252,060	$257,101	$262,243
Depreciation for Buildings and Equipment			$541,215	$541,361	$541,413	$541,457	$541,495	$541,528	$541,556	$541,580	$541,600	$541,618
Maintenance Expenses			$144,861	$147,759	$150,714	$153,728	$156,803	$159,939	$163,138	$166,400	$169,728	$173,123
Insurance Expenses			$96,574	$98,506	$100,476	$102,485	$104,535	$106,626	$108,758	$110,934	$113,152	$115,415
Property Tax Expenses			$24,144	$24,626	$25,119	$25,621	$26,134	$26,656	$27,190	$27,733	$28,288	$28,854
Total Interest Expense			$181,077	$160,470	$138,318	$114,505	$88,905	$61,386	$31,802	$0	$0	$0
Utilities Expenses			$29,400	$29,988	$30,588	$31,200	$31,824	$32,460	$33,109	$33,771	$34,447	$35,136
Miscellaneous Supplies Expenses				$0	$0	$0	$0	$0	$0	$0	$0	$0
Other Expenses*				$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Expenses		**$0**	**$1,234,579**	**$1,226,532**	**$1,214,925**	**$1,201,860**	**$1,187,217**	**$1,170,867**	**$1,152,670**	**$1,132,478**	**$1,144,317**	**$1,156,389**

Tab 6: Cooperative Summary

Preferred Stock Dividend			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Income before Patronage Refunds		**$0**	**$186,058**	**$238,230**	**$295,314**	**$355,251**	**$418,205**	**$484,347**	**$553,861**	**$626,943**	**$669,615**	**$713,724**
Cash Patronage Refund		$0	$158,150	$202,495	$251,017	$301,964	$355,474	$411,695	$470,782	$532,902	$569,173	$606,666
Common Stock Patronage Redeemed		$0	$0	$0	$0	$0	$0	$0	$0	$18,606	$23,823	$29,531
Before Tax Savings			**$27,909**	**$35,734**	**$44,297**	**$53,288**	**$62,731**	**$72,652**	**$83,079**	**$75,436**	**$76,619**	**$77,527**
Income Tax			$5,582	$7,147	$8,859	$10,658	$12,546	$14,530	$16,616	$15,087	$15,324	$15,505
Net Savings After Tax			**$22,327**	**$28,588**	**$35,438**	**$42,630**	**$50,185**	**$58,122**	**$66,463**	**$60,348**	**$61,295**	**$62,022**
*Year zero "Other Expenses" may include legal fees, licenses, permits, and other organizational expenses.												
Estimate of Cash Flows	**Year**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
After Tax Savings			$22,327	$28,588	$35,438	$42,630	$50,185	$58,122	$66,463	$60,348	$61,295	$62,022
Add: Depreciation			$541,215	$541,361	$541,413	$541,457	$541,495	$541,528	$541,556	$541,580	$541,600	$541,618
Less: Loan Principal Paid			$274,755	$295,361	$317,513	$341,327	$366,926	$394,446	$424,029	$0	$0	$0
Less: Equipment Reinvestment for Replacement			$509,217	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217	$509,217
Gross Cash Flow From Operations			$288,788	$274,587	$259,337	$242,760	$224,753	$205,204	$183,990	$601,928	$602,896	$603,640
Cummulative Cash Flow**			$288,788	$563,375	$822,711	$1,065,472	$1,290,225	$1,495,429	$1,679,418	$2,281,347	$2,884,243	$3,487,883
**Does not consider increases or decreases in working capital loan												

Tab 7: Cooperative Equity

This Sheet Summaries The Changes in Owner's Equity. There are no inputs on this page												
	Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Co-Op Membership Stock		$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358	$2,414,358
New Common Stock Issued			$18,606	$23,823	$29,531	$35,525	$41,820	$48,435	$55,386	$62,694	$66,962	$71,372
Common Stock Redeemed			$0	$0	$0	$0	$0	$0	$0	$18,606	$23,823	$29,531
Common Stock Balance			$18,606	$42,429	$71,960	$107,485	$149,306	$197,740	$253,127	$297,215	$340,354	$382,195
Preferred Stock		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Unallocated Equity			$7,442	$16,972	$28,784	$42,994	$59,722	$79,096	$101,251	$126,328	$153,113	$181,662
Total Members Equity			$2,440,406	$2,473,758	$2,515,102	$2,564,837	$2,623,386	$2,691,194	$2,768,735	$2,837,901	$2,907,824	$2,978,214
Equity Revolvement: the calculations below are used to determine the equity revolved each year based on the inputed revolving period												
Common Stock Credits Issued			**$18,606**	**$23,823**	**$29,531**	**$35,525**	**$41,820**	**$48,435**	**$55,386**	**$62,694**	**$66,962**	**$71,372**
Common Stock Credits Redeemed 1 yr. rev.				$0	$0	$0	$0	$0	$0	$0	$0	$0
Common Stock Credits Redeemed 2 yr. rev.					$0	$0	$0	$0	$0	$0	$0	$0
Common Stock Credits Redeemed 3 yr. rev.						$0	$0	$0	$0	$0	$0	$0
Common Stock Credits Redeemed 4 yr. rev.							$0	$0	$0	$0	$0	$0
Common Stock Credits Redeemed 5 yr. rev.								$0	$0	$0	$0	$0
Common Stock Credits Redeemed 6 yr. rev.									$0	$0	$0	$0
Common Stock Credits Redeemed 7 yr. rev.										$18,606	$23,823	$29,531
Common Stock Credits Redeemed 8 yr. rev.											$0	$0
Common Stock Credits Redeemed 9 yr. rev.												$0
Common Stock Credits Redeemed 10 yr. rev.												
Total Common Stock Redeemed			**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$18,606**	**$23,823**	**$29,531**
Total Common Stock Credits			$18,606	$42,429	$71,960	$107,485	$149,306	$197,740	$253,127	$297,215	$340,354	$382,195

Tab 8: Return on Investment/Comparison

Overall Individual Return	0	1	2	3	4	5	6	7	8	9	10
Initial Investment (Total PP&E)	$4,141,035										
Gross Margin - Imaging Services	$0	$355,159	$366,190	$377,560	$389,278	$401,355	$413,803	$426,633	$439,855	$453,483	$467,528
Variable and Fixed Expenses	$0	$1,024,804	$1,014,560	$1,003,047	$990,250	$976,068	$960,388	$943,092	$924,050	$932,442	$940,999
Add: Depreciation & Term Interest		$660,368	$642,835	$623,887	$603,507	$581,590	$558,021	$532,677	$505,427	$505,447	$505,464
Cash Benefits Less Costs	**-$4,141,035**	**-$9,277**	**-$5,535**	**-$1,600**	**$2,535**	**$6,878**	**$11,436**	**$16,218**	**$21,232**	**$26,487**	**$31,993**
Return on Assets (ROA)		**-16.17%**	**-15.66%**	**-15.10%**	**-14.51%**	**-13.88%**	**-13.20%**	**-12.47%**	**-11.69%**	**-11.57%**	**-11.43%**
(after tax income/total PP&E Investment)											
Return on Equity (ROE)		**-32.34%**	**-31.31%**	**-30.21%**	**-29.03%**	**-27.76%**	**-26.40%**	**-24.94%**	**-23.39%**	**-23.13%**	**-22.87%**
(after tax income/non-borrowed PP&E Investment)											
Net Present Value (NPV)	**-$4,092,886**										
Internal Rate of Return (IRR)	**-33.87%**										
Average Return on Assets (ROA)	**-13.57%**										
Average Return on Equity (ROE)	**-27.14%**										

Overall Cooperative Return	0	1	2	3	4	5	6	7	8	9	10
Initial Investment (Total PP&E)	$4,828,715										
Gross Margin - Imaging Services	$0	$1,420,638	$1,464,762	$1,510,239	$1,557,112	$1,605,422	$1,655,213	$1,706,531	$1,759,421	$1,813,932	$1,870,113
Variable and Fixed Expenses	$0	$1,240,161	$1,233,679	$1,223,785	$1,212,518	$1,199,763	$1,185,397	$1,169,286	$1,147,565	$1,159,641	$1,171,894
Add: Depreciation & Term Interest		$722,292	$701,831	$679,731	$655,962	$630,400	$602,913	$573,358	$541,580	$541,600	$541,618
Cash Benefits Less Costs	**-$4,828,715**	**$902,769**	**$932,914**	**$966,185**	**$1,000,555**	**$1,036,059**	**$1,072,730**	**$1,110,603**	**$1,153,436**	**$1,195,892**	**$1,239,837**
Return on Assets (ROA)		**3.74%**	**4.79%**	**5.93%**	**7.14%**	**8.40%**	**9.73%**	**11.13%**	**12.67%**	**13.55%**	**14.46%**
(after tax income/total PP&E Investment)											
Return on Equity (ROE)		**7.48%**	**9.57%**	**11.86%**	**14.27%**	**16.80%**	**19.46%**	**22.25%**	**25.34%**	**27.10%**	**28.92%**
(after tax income/non-borrowed PP&E Investment)											
Net Present Value (NPV)	**$2,134,278**										
Internal Rate of Return (IRR)	**16.46%**										
Average Return on Assets (ROA)	**9.15%**										
Average Return on Equity (ROE)	**18.31%**										

Tab 8: Return on Investment/Comparison

	Year										
Owner Returns (Individual Ownership)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Initial Equity Investment	$2,070,517										
After Tax Net Income	$0	-$669,645	-$648,370	-$625,487	-$600,972	-$574,712	-$546,585	-$516,459	-$484,195	-$478,959	-$473,471
Add: Depreciation & Term Interest		$660,368	$642,835	$623,887	$603,507	$581,590	$558,021	$532,677	$505,427	$505,447	$505,464
After Tax Cash Net Income	**-$2,070,517**	**-$9,277**	**-$5,535**	**-$1,600**	**$2,535**	**$6,878**	**$11,436**	**$16,218**	**$21,232**	**$26,487**	**$31,993**
Return on Investment (ROI)		**-0.45%**	**-0.27%**	**-0.08%**	**0.12%**	**0.33%**	**0.55%**	**0.78%**	**1.03%**	**1.28%**	**1.55%**
	Year										
Cooperative Member Returns	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Member 1 Initial Equity Investment	$603,589										
Member 1 Taxable Income	$0	$39,537	$50,624	$62,754	$75,491	$88,869	$102,924	$117,695	$137,877	$148,249	$159,049
Member 1 Income Tax	$0	$7,907	$10,125	$12,551	$15,098	$17,774	$20,585	$23,539	$27,575	$29,650	$31,810
Member 1 After Tax Income	**-$603,589**	**$31,630**	**$40,499**	**$50,203**	**$60,393**	**$71,095**	**$82,339**	**$94,156**	**$110,301**	**$118,599**	**$127,239**
Member 1 Return on Investment (ROI)		**5.24%**	**6.71%**	**8.32%**	**10.01%**	**11.78%**	**13.64%**	**15.60%**	**18.27%**	**19.65%**	**21.08%**

Note: The spreadsheet template has a cash return summary for each cooperative member, but only the returns for Veterinarian 1 are shown.

Preferreed Stock Return											
Dividends		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Return on Investment											
Average Preferred Stock ROI											

Cooperative Member Returns Summary			
	Average ROI	**NPV**	**IRR**
Individual Veterinarian	0.48%	-$2,022,369	-33.60%
Veterinarian Member 1	13.03%	-$122,267	4.15%
Veterinarian Member 2	13.03%	-$122,267	4.15%
Veterinarian Member 3	13.03%	-$122,267	4.15%
Veterinarian Member 4	13.03%	-$122,267	4.15%
Veterinarian Member 5			

VITA

Dillon Isaac Rapp

Candidate for the Degree of

Master of Science

Thesis: APPLYING THE COOPERATIVE MODEL TO VETERINARY MEDICINE: A CASE STUDY OF A SHARED IMAGING CENTER

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