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Key Resources Determining the Future of the Farm: Human Capital and Information Technology

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Introduction

In our previous article *Integrated Risk Management: Developing an Asset Based Business Strategy*, we explored various business, financial, and strategic risks, along with strategies to safeguard your organization against these potential threats (Lippsmeyer, Langemeier, and Boehlje, 2024). A crucial strategy in protecting an enterprise amidst increased risk involves strengthening and maintaining the business's key resources. This article emphasizes the significance of human resources and information technology (the ability to manage and analyze data) as we transition into a new era of production agriculture.

This new era brings further innovation of agricultural technology, information processing, and use of artificial intelligence to digitize agriculture. We expect this transition to improve agricultural production efficiency both in the U.S. and internationally, utilizing data-driven insights and shifting towards more industrialized practices. While new technologies may introduce risk, by effectively managing and leveraging key resources farms may transition smoothly to new production technologies, further develop business strategies, enhance efficiency, and strengthen competitive positioning.

What Are Key Resources?

Key resources play a pivotal role in determining a business's performance. These resources include financial resources, physical resources, human resources, intangible resources, and information technology, each capable of significantly impacting an operation's direction and enterprise mix. Financial resources and physical resources are widely recognized as being an essential ingredient to farm success. Financial resources encompass cash and other accessible funds a business can utilize. Physical resources refer to essential operational assets such as machinery, buildings, and land. Intangible resources include reputation, branding, and intellectual property.

The focus of this article is on two types of capital that are less well understood but increasingly vital for producers: human resources and information technology (the ability to manage and analyze data). Human resources represent the workforce of a business. Prior research stresses the importance of retaining and investing in employees, highlighting advantages of maintaining a consistent workforce with minimal turnover. Information technology parallels the concept of surveillance capital, a term initially coined by Harvard Business School professor, Shoshana Zuboff, which relates to the collection, analysis, and use of data collected by media platforms to customize user experiences (Zuboff, 2019). We apply this concept to agricultural data, specifically the financial and production information collected by producers. Similar to how data is utilized in social media to cater viewing experiences to each individual user, surveillance capital has the potential to be applied in production agriculture, using sophisticated algorithms to tailor farming practices to each farmland plot. Such data, including forecasted and actual financial data, commodity prices, cropping rotations, input rates, yields, tile line spacing, changing weather patterns variable rate input applications, and soil composition is readily available to farmers and can be leveraged in a manner akin to user data on media platforms, enabling the creation of customized application rates for each farm, which meet unique production goals.

Use of Surveillance Capital/Information Technology

Information technology is on the forefront of research in production agriculture. John Deere, Bayer, Cargill and other mainstream companies have all developed platforms capturing the value of information technology and innovating agribusiness with artificial intelligence. Other efforts by the USDA National Institute of Food and Agriculture, in collaboration with universities nationwide, are using production data from randomized agronomic field trials to facilitate on-farm precision experimentation and enhance production decisions (Bullock et al., 2019). These examples illustrate the burgeoning use of farm data, signaling a move towards broader adoption of data driven insights and applications of surveillance capital in agriculture.

The following passage provides a more detailed explanation of the role of surveillance capital. “The economic orientation acts as the puppet master, with technology as its puppet. Thus, surveillance capitalism is not merely about algorithms, sensors, machine intelligence, or platforms, though it relies on all of these to manifest its intentions. If technology represents the bone and muscle, then surveillance capitalism is akin to the soft tissue that connects and orchestrates these elements into purposeful action” (Zuboff, 2019).

The utilization of information technology binds together the data we already collect and the technologies we already use, with the potential to identify optimal interaction between production practices, economic conditions, weather patterns, and more. Such decision-making tools hold promise for reducing uncertainties in agricultural production, aiding farms in identifying the most profitable business strategies within their operational constraints.

While applications of information technology for farming operations is still evolving, particularly alongside the evolution of artificial intelligence, its importance cannot be overstated. So, while many producers may not consider the concept of ‘surveillance capital’ a key resource in current production systems, its potential to improve production efficiency, management, and reduce costs is not inconsequential.

Advancements in artificial intelligence have had a drastic impact on manufacturing, cybersecurity, transportation, entertainment, and finance - increasing sector efficiencies and productivity, while reducing associated risks and costs (Espina-Romero, et al., 2023). Similar shifts in production agriculture have tremendous potential to improve on farm decision making, optimize use of constrained resources, and reduce need for additional farm labor. The abilities of artificial intelligence to capture and process vast quantities of information are incomparable to human led analysis, leaving significant potential for improvements in information processing to make decisions in real time.

However, leveraging this data is only possible with consistent, organized collection and storage of farm data. This presents a major difficulty for many producers, because of the lack of standardized guidelines for how data collection, storage, management, and analysis should be performed. Further discussion on the need for standardized data infrastructure in agriculture is provided by a joint publication by the Data Foundation and the AGree Initiative (2022). While guidelines data collection and management are not

available on a nationwide basis, resources on data entry, storage, and sharing are provided by Buckmaster (2023) through the Purdue College of Agriculture.

Investment in and Retention of Human Capital

Increasing use of information technology for production agriculture may lessen the need for additional farm labor, particularly under increasing use of autonomous vehicles and enhanced decision making with data driven insights, however, we do not anticipate replacement of farm owner/operators with technologies. Rather, we anticipate a need for significant advancements in how human resources are leveraged, increasing the proficiency of using data and precision agriculture technologies.

While the advent of new technologies is transforming the landscape of agribusiness decision-making - production decisions, their implementation, and management under uncertainties remain an irreplaceable responsibility of farmers. The breadth of knowledge and experience required for managers and employees to effectively conduct day-to-day farm operations is substantial, not to mention the additional skills needed for less frequent tasks like crop rotation planning and budgeting. This underscores the ongoing need for updating human resources, particularly pertaining to the collection and analysis of data (Langemeier and Boehlje, 2021).

Attracting and retaining skilled employees is crucial for all businesses, but especially for the agricultural sector since employee skills are built and refined over time. In a nationwide survey of 403 commercial producers conducted in April 2023 by the Purdue Center for Commercial Agriculture 22% of respondents indicated that limited availability of skilled farm labor as a significant threat to their business. However, the challenge extends beyond attracting talent; it also involves retaining it. Factors influencing employee retention include employee recognition, opportunities for growth, involvement in decision-making, work-life balance, a positive working environment, healthy supervisor relationships, training opportunities, and job security (Lahkar Das and Baruah, 2013).

While many farms benefit from strong employee-management relationships that aid in retention, maintaining long-term employees remains a significant challenge. Competitive compensation packages offered in other sectors, alongside unique ownership structures in farming, which limit employee promotional opportunities, and the high cost of capital, which restricts growth opportunities, pose compounding obstacles for employee retention in agriculture.

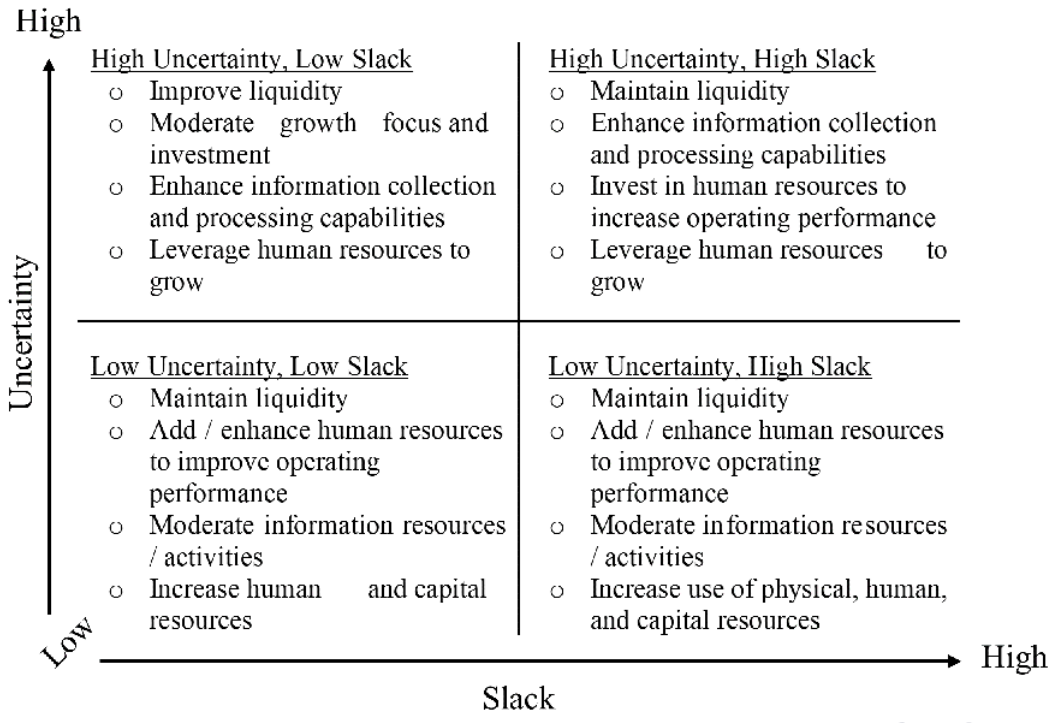
Managing Key Resources

Financial resources, physical resources, human resources, intangible resources, and information technology are interdependent, with the management and enhancement of each reliant on the others. Strategies to manage these key resources should align with two primary factors: the levels of uncertainty in the business environment and the amount of slack available within the enterprise.

Uncertainties in production agriculture are influenced by various factors, including the stability of input prices, government policies, international trade agreements, fluctuating crop prices, interest rates, the business's reputation, and product demand. Slack, on the other hand, refers to the surplus resources that a business possesses but is not currently using. The presence of excess or slack resources has typically been perceived to be undesirable in production agriculture – inconsistent with the mantra of being “lean” to maintain a competitive position as a low-cost producer. But “slack” has benefits in managing risk, particularly strategic risks. It reflects the absorptive capacity to weather unforeseen stressors and agility to adjust quickly, capturing opportunities when they arise.

When a business has a high level of slack resources and faces relatively low uncertainty, it is an opportune time to invest in key resources. Such investments might involve enhancing physical capital, hiring new staff, offering promotions, investing in employee development, or allocating resources to improve data management, collection, and processing systems related to surveillance capital. Conversely, in periods of high uncertainty when a business has limited slack, the focus should be on maintaining existing key resources rather than undertaking substantial new investments. Figure 1 provides a matrix of suggestions for how to manage key business resources under varying levels of slack and uncertainty.

Figure 1. Management Activities Under Varying Uncertainty and Slack



Conclusions

Businesses often make critical missteps by not investing in key resources during prosperous times and hastily retrenching when faced with uncertainties. This reactionary approach often leads to regrettable decisions, such as workforce layoffs, deferred maintenance, and the creation of perverse incentives to slash costs at the expense of long-term viability. Examples like Tri Valley Growers, Rice Growers Association, and Lilydale epitomize businesses unable to access sufficient capital to grow or maintain their businesses (Fulton and Hueth, 2009). These cooperatives failed to invest sufficiently in key resources when market conditions were favorable, ultimately leading to insufficient cash flows and bankruptcy. These insights dovetail with previous discussions by Lippsmeyer and Langemeier (2023) on the crucial role of maintaining slack resources to buffer against unfavorable conditions.

To navigate complexities, farms and agribusinesses must adopt a nuanced approach to managing key resources. This involves not just safeguarding against present challenges but also preparing for future uncertainties through continuous reassessment of the business environment. Farms must recognize the importance of investing in and nurturing key resources during periods of stability. These investments, particularly in human resources and information technologies, are not mere expenditures but foundational pillars that will support the enterprise during times of heightened uncertainty and industry evolution.

By cultivating a robust human capital infrastructure, farms ensure that skilled and knowledgeable employees drive their operations. Similarly, investing in information technology will enable farms to make more informed decisions, improve efficiency, reduce cost, and pursue further technological innovation.

As we progress further into the era of digital agriculture, the key to thriving amid uncertainties lies in the strategic investment and stewardship of key resources, including human resources, financial resources, physical resources, intangible resources, and information technologies. Farms must be agile yet resilient, lean yet buffered, technologically advanced yet human-centric. Strategic investment in and leveraging of key resources, especially information technology and human resources, will promote a competitive advantage amid a new era of production agriculture, driven by data.

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