Developing a Value-Based Procurement Business Model
A Coordinated Business Approach

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Author Note: This paper, “Developing A Value-Based Procurement Business Model - A Coordinated Business Approach”, and related materials, were developed with a grant from the United Soybean Board (USB)

The United Soybean Board (USB) is the governing body that instantiates the U.S. commodity checkoff program for soybeans. It is made up of 73 volunteer farmer-directors who oversee the investments of the soybean checkoff on behalf of all U.S. soybean farmers.

The soybean checkoff is a congressionally mandated assessment on soybeans, whose proceeds are used to fund soybean research and promotion efforts. The checkoff is managed by the United Soybean Board under the supervision of the United States Department of Agriculture Agricultural Marketing Service.

Checkoff funds are invested in the areas of animal utilization, human utilization, industrial utilization, industry relations, market access, and supply. As stipulated in the Soybean Promotion, Research, and Consumer Information Act, USDA’s Agricultural Marketing Service has oversight responsibilities for USB and the soybean checkoff.

As such, the intended audience for this paper and related materials are users of soybeans and soybean products of soybean meal and soybean oil; and more specifically feed manufactures and integrated livestock procures.

Developing an Effective Value-Based Procurement Model A Coordinated Business Approach

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I. INTRODUCTION

Why does any organization need to consider its procurement activities within its current business model and its collaborative relationships across organizational activities?

The answer is: It all depends on the organization's goals and strategic objectives, as well as how procurement and purchasing is perceived by senior management within the organization.

Are the organization's goals and strategic objectives to produce a "least cost" product that will compete at the low-value-end of the market, or a "value" product competing in the higher-value-end?

Is procurement and purchasing currently perceived as performing a value-added function collaborating in areas across the organization, or, is procurement and purchasing just a mere support function whose primary activity is to create purchase orders for suppliers and ensure that the correct product is delivered on time at the correct location?

The answer to this question of how an organization's management perceives the function of procurement and purchasing will drive the organizational culture, as well as the resulting organizational structure.

If procurement and purchasing is very well respected and considered a value-adding partner in the organization's activities, then you can stop here. For those who are struggling with this question, please read on to consider the possibilities.

Procurement and purchasing is an important function in many commodity based organizations that are involved in the manufacturing or production of food, feed, energy and many other value added products.

Generally, an organization will take a "least cost" approach to procurement of inputs needed for the creation of products or services.

In a "value-based" procurement approach, the value of procured inputs of goods or services are determined as a comparison of "costs vs benefits", or "value".

Developing an effective value-based procurement business model can be an important step to maximizing an organization's profit potential.

Many organizations have not devoted sufficient time and resources to pursuing the best approach to their procurement and purchasing activities in an effort to maximize profits, operational efficiencies, and strategic priorities. Achieving the approach may mean adopting a different perspective on how procurement engages with production, sales, management and accounting. Success may mean taking a more holistic approach in these efforts that consider improvements to the short-term P&L, as well as longer-term strategic initiatives.

The objective of this paper and related presentation is to provide a better understanding of:

- The procurement and purchasing function of an agricultural commodity-based business;
- Insight into the function of supply chains, value chains, and supply webs;
- How a coordinated value-based business model can increase economic returns to the organization.

Establishing a foundation for long term success, organizations will likely need to address structural and reporting issues beginning with procurement and purchasing. Understanding how both procurement and supply chain management function will help you build a resilient, sustainable organization that can stay unmoved and exceed your customers' expectations always.

What we want to better manage is using existing expertise to achieve a better understanding of the nature of procurement transactions which can minimize costs and risks, while maximizing value. Too often that later objective is overlooked.

II. PROCUREMENT & PURCHASING

The differences between “procurement” verses “purchasing” are frequently misunderstood, as the two terms are often used interchangeably. However, in the business world, these two functions are quite distinct.

Failing to understand the key differences may result in an organization overlooking key business drivers that have the potential to significantly impact risk exposure and bottom-line financial results.

A. WHAT IS PROCUREMENT…?

Procurement is a subset within the supply chain supporting production activities. It is considered to be the sum total of effort and activities that go into identifying and acquiring the inputs an organization requires to carry on its business activities efficiently and effectively.

Unlike many financial and monetary instruments, commodities and other goods have a physical component that intrinsically contributes to “value”.

Procurement exists as a very significant support function within business management as its focus is ensuring the constant flow of the supplies into the organization for processing into finished products.

Procurement goes far beyond just purchasing supplies needed to run the business’s daily operations. More specifically, procurement is concerned with what happens throughout the input supply chain process from the moment an organization determines what input supplies are required, until the time the input is delivered to and utilized in the production process.

Procurement comprises a number of activities required to get critical inputs and services from the suppliers to the organization's location. These include, but may not be limited to:

1. Forecasting current and future input requirements in an environment of changing market conditions;
2. Assessing and quantifying the market and market conditions of available inputs;
3. Spotting potential suppliers and vendors;
4. Creating a list of approved or preferred suppliers and vendors;
5. Quantifying internal needs and requirements, including components of the contract or purchase order.
6. Identifying, selecting, and acquiring suitable goods or services from a supplier or vendor through a method of direct purchase, competitive bidding, or tendering process while ensuring timely delivery of the right quality and quantity.
7. Requesting proposals, quotes or offers for supplies or services and evaluating the results.
8. Selecting the right supplier and effectively negotiating terms of a contract or purchase order, as well as distributing copies of this document to other appropriate parties both internal and external.

9. Managing the execution of contracts or purchase orders, including, but not limited to; the receival of the supply of products or services, assessment of quantity and quality, along with the appropriate documents.
10. Confirming fulfillment of contracts, reviewing invoices and approving payment according to agreed payment terms.
11. Establishing and maintaining good supplier relationships.

B. Direct and Indirect Procurement

Procurement can be divided into two functional areas: direct and indirect.

While both, direct and indirect procurement, are essential to the smooth operation of every organization, it is important to understand their function so that their procurement can be prioritized. Each issue requires the appropriate priority and emphasis to ensure a steady flow of inputs required to keep the organization operating, efficiently manage procurement activities. In this effort we are also able to establish critical supplier relationships,

Direct Procurement

Direct Procurement is the process of acquiring essential inputs of supplies, goods, and services needed to facilitate the organization's core business activity and that directly impacts the profitability of the business.

This effort frequently includes agricultural products such as bulk grain and oilseeds, as well as a range of their products, such as; flour, meals, protein meals, malt, ethanol (or other forms of alcohols), vegetable oils, etc., that with some further processing will make their way into a finished product being produced.

It can also include the purchase of goods for resale; i.e., wholesale to retail.

In addition to these, it may also include the purchase of equipment, machinery or technologies used to produce goods or services.

Some examples of direct procurement include:

- a baker buying the flour for baking bread;
- a feed mill buying corn and soybean meal (SBM) for manufacturing feed;
- a livestock producer buying corn, soybean meal and other feedstuffs for the production of beef cattle, pigs or poultry;
- a clothing manufacturer ordering fabric, buttons and textiles for processing and sewing down the line;
- a construction company making an order for lumber, cement and blocks for a building project.

Note: Direct Procurement features predominately in agricultural and food production, as well as in physical manufacturing industries where inputs of physical raw materials are processed into physical products.

Indirect Procurement

Indirect Procurement is the process of acquiring products and services that are critical to your company's daily operations and business activities, and that indirectly impacts the profitability of the business.

An example of indirect procurement includes goods and services that support the business' non-essential operations. It includes items that are not directly related to the output of the finished product delivered to the customer. However, indirect supplies are, in their own way, still essential to the organization. They play a supporting role to ensure that the process of turning direct supplies into finished goods goes smoothly.

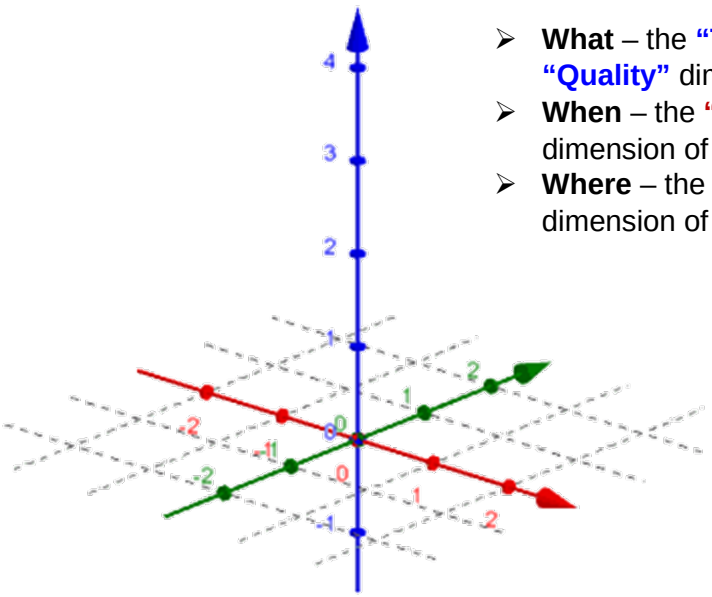
Some examples of indirect procurement include:

- Office and location rentals;
- Utilities, such as electricity, water, sewage, etc.,
- Communications, such as internet and telephone connections, etc.,
- Employee uniforms, safety equipment, tools, etc.,
- Office supplies and equipment, such as computers, laptops, printers, and photocopy machines, and maintenance fees, as well as stationery, decorations, etc.,
- Travel and entertainment expenses;
- Subscriptions, software, market news and quotes services;
- Advertising and marketing expenses.

Note: Indirect Procurement is more pronounced in digital fields and sectors where intangible goods are produced, and more closely related to the delivery of services to a customer.

C. Determining Value

When considering procurement and purchasing decisions, it is best to break the "value" equation down into three separate components or dimensions, and then consider each of these individually. These three strategic dimensions are: What (typical), When (temporal) and Where (spacial).



- **What** – the **"Typical"** or **"Type"** and/or **"Quality"** dimension of Price.
- **When** – the **"Temporal"** or **"Time"** dimension of Price.
- **Where** – the **"Spacial"** or **"Location"** dimension of Price.

For each situation, each of these components of the value equation can be negative or positive. After each component is given appropriate consideration, they can be summed to determine a total value determination for an objective comparison.

- **Typical** - Type, Class, Quality, and Quantity - *(What)* Determining the specifications of:
  - Type and form of the input;
  - The underlying quality standards or technical specifications these inputs are required to meet, as well as any quality premiums or discounts that may be applied to various commodities.
  - The quantity or number required for a particular delivery period.

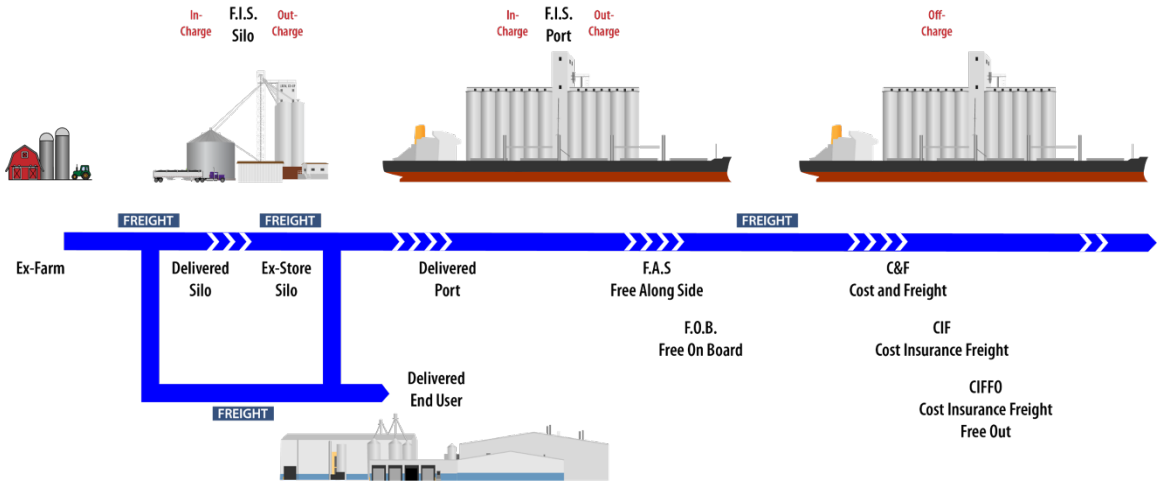
Note: The capacity to formulate a commercial schedule of quality premiums and discounts is largely determined by a particular organization's capacity to manage and extract value / or manage losses over a varying range of quality factors.

- **Temporal** - Time - *(When)* Determining a timeline for delivery of supplies and services, as well as whether a portion of these inventories will need to be warehoused and stored.
  - A common phrase found in the terms and conditions of many contracts for the purchase / sale of commodities is; "Time is of the essence". In other words, "Time" is of great importance or key consideration; i.e. "Time is money!"
  - Too often in procurement and purchasing activities, the importance and value of time is overlooked. An effort is not made to do a proper analysis of realistically assessing relevant timeframes, laying out expectations of what is required and when and where, as well as considering future demand and workloads, ahead of committing to a time frame.
  - There are many instances in which the value of a transaction within a company is diminished by delays in execution. Yet, most organizations do not have a consistent

mechanism for addressing a situation in the context of quantifying the financial impact or loss that is incurred from untimely execution of a deal, compared with the value of the originally agreed terms and conditions.

- Too frequently, an organization does not fully quantify the total business case of value, in a macro view, when time, quality, or locational issues arise that can impact not only the price / total cost of a commodity, but its intrinsic value as well. These challenges are sometimes referred to as “procurement myopia”, which needs to be overcome if the organization is to consistently capture real value that impacts the organizational bottom-line.

- **Spacial** - Location *(Where)* Determining the location and place for delivery of supplies and services. This may be into a centralized warehouse, and/or to a particular location where they will be further processed.



As an agricultural commodity moves spacially from farm gate through the supply chain closer to its final destination, it will increase in value.

TRANSPARENCY AND DETERMINATION OF VALUE

As market participants consolidate and integrate across the supply chain, price transparency for many commodities and goods continues to decline.

While the price of a particular commodity, such as SBM, may be readily available, the detailed break up of its value in terms of quality and other pricing components may not be clearly defined. It will be the function of a skilled procurement officer to be able to break this down into its appropriate value for each component. In many organizations, commodity purchase decisions are based more on experience than on a structured mechanism. The seasonal timing of purchases and quantity can be crucial in making these decisions.

Often pricing for a specific category, type, and quality of a product is not readily available. As such, a product’s relative value must be determined in relationship to a related basic category commodity price. However, this often presents a situation where the specific product price does not move exactly in sync with the underlying category of the commodity price. In these situations a suitable historic correlation between the two must be clearly established.

For example: While CME SBM Futures may provide the underlying benchmark commodity price for the category of feedstuff proteins, the relative value of each type and sources of various SBM qualities must be carefully considered. This approach can also be expanded to include other feedstuff proteins such as canola meal, cotton seed, sunflower meal, or even animal protein meals such as meat and bone meal (MBM) or fish meals.

To meet this challenges organizations are increasingly engaging a range analytics tools, software and skill sets to increase the understanding of these relationships, and better define the underlying value proposition for alternative input products.

D. WHAT IS PURCHASING

Purchasing is a subset of procurement and focuses on the transactional activities associated with buying inputs of both supplies and services. The key focus of purchasing is being able to achieve short term goals of securing supply, including factors such as quantity and quality (what), timing (when) and location (where), as well as costs.

Activities involved within the purchasing process include:

1. Identifying, selecting, and acquiring suitable goods or services from a supplier or vendor through a method of direct purchase, competitive bidding, or tendering process while ensuring timely delivery of the right quality and quantity.
2. Requesting proposals, quotes or offers for supplies or services and evaluating alternatives.
3. Selecting the right supplier.
4. Effectively negotiating terms of a contract or purchase order.
5. Sending a confirmation of the contract or Purchase Order to the supplier and distributing copies of this document to other appropriate internal and external parties, paying particular attention to back office accounting and logistics.

CONTRACT MANAGEMENT

Contract management is a very important responsibility in the procurement process. It has been cited that a large portion of the final cost of goods and services, or their intrinsic value, is captured or lost through this process; i.e., the contract value is captured or savings are lost in the execution of the contract agreement.

In some organizations, the contract agreements are set up by the procurement and legal teams and then these are passed on to the teams who own and manage these contracts for the life of the contracts. If the contract manager does not fully understand the contract terms or their implications, the full value of the agreed purchase arrangement may not even be realized, resulting in a loss of value.

Managing the execution of contracts or purchase orders, includes, but is not limited to;

1. The receival of the supply of products or services, assessment of quantity and quality, along with the appropriate documents.

2. Confirming fulfillment of contracts.
3. Reviewing invoices and approving payment according to agreed payment terms.

Management of Transactional Cost Savings

Across the entire procurement cycle, efforts are spent on transactional activities such as; creating purchase requisitions, orders, invoicing, data management, etc. Often these activities become burdensome and unnecessary. Efforts should be made to keep these efficient and streamlined. There is a definite value to reducing the per transaction cost of procurement to the organization. This can be achieved by:

- avoiding manual entry, and multiple entry, of the same data and information;
- automating the capture of input data;
- properly formatting and automating much of the reporting process.

This should be measured and reported to show the value generated through decreased cost of business by managing the transactions at a lower cost and directly adding value to the bottom line of the business.

E. Life-Cycle of Procurement

The life cycle of procurement includes all the steps involved in obtaining goods and services, from defining your business needs to soliciting bids, awarding contracts and managing supplier relationships.

Procurement teams must act as a trusted advisor. They can add value by asking the right questions. Consider the life and future need of organizational requirements. The scope of these needs must be clearly understood and taken into account when procuring goods and services. This will result in optimization of inventories and reduced waste, further resulting in value generated to the business.

An effective procurement officer or team must take full responsibility and ownership of the "life cycle" of the procurement requirements and related contract management.

To capture the full value of a transaction, performance and compliance with the agreed terms and conditions need to be monitored and tracked through to the expiration of the contract. This includes the active management of the contract, including regular conversations and dialogue with key supply chain stakeholders with an objective to generate and capture more value where and whenever possible.

In addition, we often see a tendency to be optimistic in the demand management of the goods and services resulting in over-specification and generally ordering more than required.

Often, as a transaction is being executed, and delivery of goods commences, issues may arise that are likely to require an amendment to the original terms of the contract or purchase order. These issues often occur in the form of price, quality or timeliness of delivery. While it is important to resolve these issues in a commercially amicable manner, the situation is also likely to present an opportunity to improve the value proposition in an amended deal. Care must be taken not to give away the original value components negotiated in the original deal.

III. SUPPLY CHAINS, VALUE CHAINS, NETWORKS AND WEBS

Today, procurement and purchasing professionals are not just price negotiators. They are expected to have a greater understanding of both the commodity or goods they are procuring, as well as the supply chain that delivers them from both the supplier, as well as to the final customer

As such, they must obtain a deeper understanding of relevant supply chains in such a way that they are able to leverage their organization's position and determine the appropriate price and value of the supplies they are purchasing.

Understanding how both procurement and supply chain management function is necessary to manage organizational activities effectively. Within this context an organization must develop the necessary capabilities to create a resilient and sustainable business that can deliver goods and services that meet market and customer expectations.

A. WHAT IS A SUPPLY CHAIN?

A supply chain is a system that consists of activities and assets that convert raw materials and inputs into further processed or finished products which are then distributed to clients, customers or end users.

Supply chains can produce both goods or services, or a combination of both. In this paper we will primarily focus on those components that deal with physical goods.

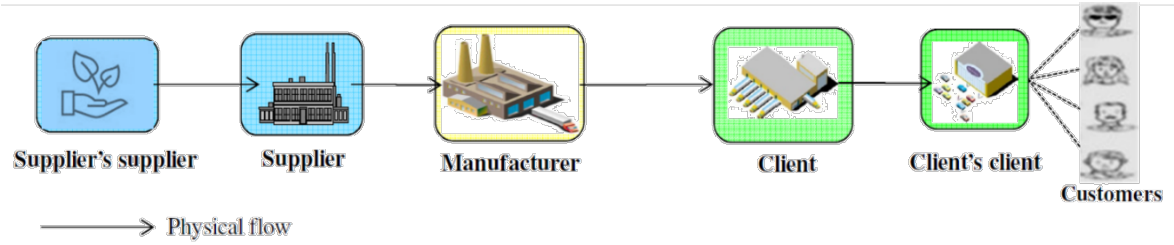
Typically, a supply chain can be divided into two stages: Production and Distribution.

In the Production Stage, input components, first stage processing and semi-finished parts are produced on farms and in manufacturing centers. These input components are then combined.

The Distribution Stage consists of transportation along with warehouses that store the goods at central and regional distribution centers. From these locations the final products are transported to the end users.

Supply chains can be simple or complex. Not only do they provide inputs and raw materials, product storage and handling, as well as transportation services; but they may also provide other ancillary services that are utilized to manufacture and move the product.

Supply Chain Management deals with the flow of inputs to the point of manufacturing, then out to the subsequent client, customer or end user in the most efficient manner.



Source: Hakimi, Montreuil, Labarthe (2009) "Supply Web: Concept and Technology" (*Modified*) [i]

In a traditional sense, a supply chain diagram can be viewed as having a linear unidirectional structure with downstream product flow through a set of locations or nodes. Generally they have a single focal point of organizational activities. The diagram typically depicts suppliers on the left-hand side feeding into the operational location or manufacturer, while the right-hand side of the operational location or manufacturer is feeding its client, who in turn feeds its own client who serve a number of final customers. [ii]

Understandably, the supply chain diagram of an industry or organization varies depending on the product(s) or service(s) being produced; as well as the number and variety of inputs being required to procure that set of product(s) or service(s) being delivered.

It is important to note that procurement is only one-half of the supply chain management process, with the delivery of goods or services into the marketplace or into the hands of a customer being the other half.

In a more complex supply chain system, suppliers may be ranked by "tier", with a grain producer supplying a “first stage” processer (first tier), who then supplies a “second stage” processor (second-tier), and so on; until the product(s) reach the final end user or consumer.

B. What is a Value Chain?

A “Value Chain” is a progression of activities that an organization operating in a specific industry may perform, starting with raw materials and ending with the delivered valuable product or service to an end customer.

[This concept comes through business management and was first described by Michael Porter in his 1985 best-seller, Competitive Advantage: Creating and Sustaining Superior Performance.] [iii]

It is based on the notion of “value-added” link, where the sum total of “link-level value-added” yields total value. This concept can be overlaid on the production process, or extended to the corresponding supply chain, with the value added at each link or step in the process noted.

> *The idea of the value chain is based on the process view of organizations, the idea of seeing a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and affects profits.*
>
> *— "Decision Support Tools: Porter's Value Chain". Cambridge (IfM)* [iv]

In Porter's concept of Value Chains included five primary activities; Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service, as well as four secondary activities including; Infrastructure, Procurement, Human Resources, and Technological Development. [v],[vi]

This concept of a “Value Chain” was added into strategic business considerations as early as 1979. Subsequently, the emergence of global value chains in the late 1990s provided a catalyst which accelerated a change in the landscape of international trade and investment, which had far-reaching impacts on private enterprises, as well as government policies in the development of a globalized economy. Commonly associated with export-oriented trade, practitioners have begun to highlight the importance of developing national and intra-regional chains in addition to international ones. [vii]

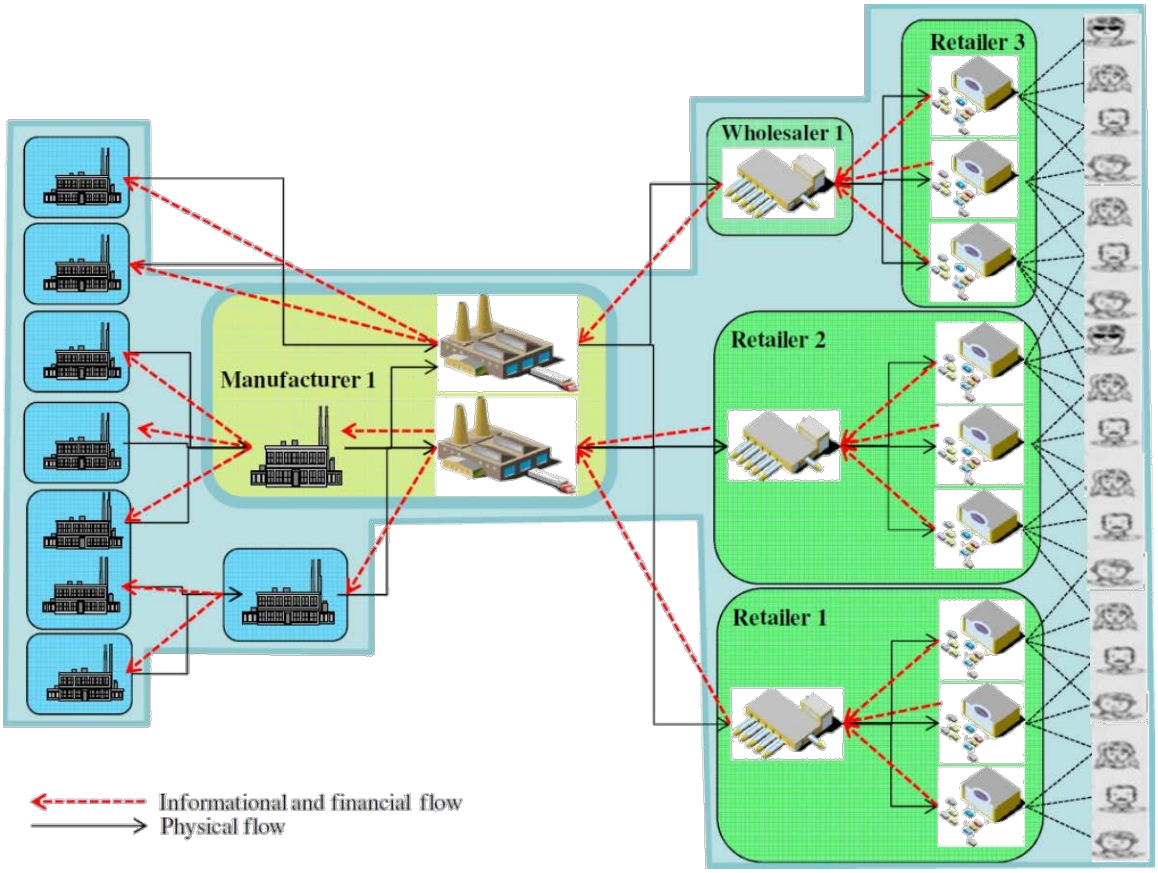
A “Supply Chain” or “Value Chain” can be thought of as a complex and dynamic supply and demand network. At the end of the supply chain, materials, and finished goods only flow to the end user as a result of customer behavior and price signals that are initiated at the end of the supply chain processes in order to meet the end user’s buying behavior.

It is important to note that it is the market that determines “value”. This can occur at points along the supply chain where the goods have access to viable “pricing point” in the market.

To achieve a profit, the value added to a good or service produced must exceed that of the sum total of all the inputs required to manufacture that good or service.

As such, a procurement manager must be able to interpret price signals observed in the market, as well as send clear price signals back through the chain to relevant suppliers.

C. What is a Supply Network?



Source: Hakimi, Montreuil, Labarthe (2009) “Supply Web: Concept and Technology” (*Modified*) [viii]

The diagram above presents an example of a supply network for Manufacturer-1. Internally, it shows that Manufacturer-1 has two warehousing / distribution locations and one production / manufacturing plant supplying them.

In the hypothetical case of a manufacturer of Pet Food (Manufacturer-1) utilizing protein meal, (and as for other products manufactured from agricultural commodities); “Upstream” typically consists of farmers and producers of agricultural commodities, along with origination and warehousing (i.e. the country elevator), and possibly first stage processing.

The previous section of the diagram may depict a number of (7) soybean crushing plants, represented by six suppliers. The top two, on the left (1 and 2), are directly supplying the upper final product plant of Manufacturer-1. The next two crushing plants (3 and 4) are supplying Manufacturer-1’s internal module plant. The next (4 and 5), including a supplier which has two crushing plants (5 and 6) from which it feeds both the internal module and external module plants. The last crushing plant (7) solely feeds an external module plant.

“Downstream”, the diagram shows that the first of Manufacturer-1‘s production plant supplies the distribution center of a Wholesaler-1 that services Retailer-3’s three stores. The second of Manufacturer-1’s production plant focuses on supplying both Retailers 1 and 2, via each of their unique distribution centers, and subsequently to each of their retailers.

The first retailer’s distribution center services three stores, so does the second and third retailer’s distribution center.

In summary, the supply network shows all sites and flows involving the manufacturer’s products and services.

A linear supply chain diagram often overlooks the complexity of many supply structures since they may not explicitly show other non-linear and dimensional relationships that may exist with other parties that can deeply affect behavior of strategic partners and the resulting supply chain performance.

As such, when considering the other commercial relationships, the linear supply chain representation is often extended to appear more like a “supply network” than a “supply chain”.

The notion of a supply network emerged to assist in explaining the effects occurring between overlapping supply chains, as well as to introduce softer behavioral aspects of supplier performances.

Supply networks can be said to consist of interconnected entities whose primary purpose is the procurement, use and transformation of resources to provide packages of goods and services.

Mapping the entire supply network of the manufacturer provides a view of its relationship with both upstream suppliers and downstream clients or customers. Supply networks therefore essentially consist of a set of interconnected supply chains, encompassing both upstream and downstream relationships.” They generally exist as components of wider inter-organization value creation networks, for example including innovation partners as well as marketing partners.

A supply network is a mapping of processes that address typical, temporal, and spacial (what, when and where) processes, carried out at an organization’s operational locations (nodes) and through a series of distribution links, which adds value for customers through the manufacturing and delivery of the final goods or products. The network is comprised of the general mapping of all steps in the process, from the procurement of inputs to the delivery of the finished product, showing the transformation of the inputs as they moved between various value-added points in the process, and maximizing the value added to the final product delivered to the customers.

The term "supply network" is often referred to in high-tech industries where the phenomenon of contract manufacturing is utilized by the brand owner, who physically does not touch the inputs or creation of the final product. Alternatively, the brand owner coordinates production activities through contract manufacturers and suppliers.

For example, in the semiconductor industry, a work-in-process moves from fabrication to assembly, and then out through a distribution network to the customer. This business practice requires the brand owner to maintain a high degree of oversight across each step of the process, with multiple suppliers and clients simultaneously.

D. What is a Supply Web?

A Supply Web can be defined as a network of interrelated supply networks, each embedding interlaced supply chains, involving multiple organizations with collaborative or competitive supply relationships. At the extreme, the Supply Web includes all suppliers with their relationships and flows. However, in practice, a Supply Web is generally scoped around the supply networks of a set of targeted key participants, i.e., those defining an industry. [ix]

Supply Webs generally include many industry participants, including a complex set of flows and relationships between them. An industry representation in totality often looks like an indescribable and undecipherable plate of spaghetti. As such, it is critical to examine such diagrams through selected views depicting targeted subsets. However, such a view is frequently incomplete, offering only a partial understanding of relationships and commercial impact. This lack of completeness precipitates from the fact that the supply network of each network participant may involve other participants not directly related to the business activities of Manufacturer-1, yet having an impact on these actors and indirectly on Manufacturer-1. [x]

For example, if a supplier is also supplying another competing manufacturer and is constantly having to decide which one is the favored recipient of its limited production capacity, then the supply network depicted in the previous diagram may be insufficient to understand its overall dynamics of supply stakes and risks. It is only through working over a period of time within an industry that these relationships and dynamics become apparent.

Implications of Considering the Supply Web

The “supply web” concept includes the concept of supply network, which in turn includes the concept of supply chain. This approach certainly broadens the field of view for practitioners and researchers, as well as increasing the level of complexity that can be observed. Significant importance in supply web modeling is given to the finer details and relationships between supply chain elements and their underlying relationship to each other. It allows the consideration of elements that may be overlooked despite their major impact on supply chains and supply networks.

The complexity of a supply web does not necessarily imply complexity in supply chain management. In contrast, this view can provide the opportunity to better understand influences within the supply web environment, and on operational decisions impacting the supply chain.

Consideration of the supply web environment does not imply that managers will need to be managing supply chains that are unrelated to their networks, or that their tasks will be more complicated. What it suggests is that if a supply chain manager better understands the whole of the supply web, they will be able to better judge elements and information that may influence operational decisions impacting their own supply chain activities. Supply chain managers should

be able to focus on a specific issue arising within a realistic context and determine their potential implications.

Within the context of a supply web concept, the focus is not only on the elements of nodes and links, but also considers the direct and indirect impacts of changing dynamics and behaviors between elements within the greater supply web environment.

IV. SUPPLY CHAIN MANAGEMENT

In 1982, Keith Oliver, a consultant at Booz Allen Hamilton, is credited with the creation of the term “Supply Chain Management” (SCM) after using it in an interview for the Financial Times. [xi]

In 1983 Wirtschafts Woche in Germany published for the first time the results of an implemented and so called "Supply Chain Management Project", led by Wolfgang Partsch. [xii] The term was used to express the need to integrate the management of key business processes from end user back through to the original suppliers. By the mid-1990s, the term "supply chain management" had gained popularity with several articles and books published on the subject.

A. WHAT IS A SUPPLY CHAIN MANAGEMENT?

A definition of Supply Chain Management (SCM) is: The "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally." [xiii]

Supply chains were originally defined as encompassing all activities associated with the flow and transformation of goods from raw materials through to the end user, as well as the associated information flows. Supply chain management was subsequently defined as the integration of supply chain activities through improved supply-chain relationships to achieve a competitive advantage. [xiv]

The basic idea behind Supply Chain Management is that organizations and companies that are involved in a supply chain exchange information about market demand, distribution capacity and production capabilities. For agricultural commodities and their related products this is generally facilitated through open market transactions of buying and selling.

In businesses dealing with agricultural commodities, Supply Chain Management deals with;

- The procurement and purchasing of materials, inputs or components,
- Logistics and marketing channels that allow the inputs to be converted into a finished product and delivered to the end customer,
- Operational management (ensuring the production capacity and flexibility in the production of high-quality products at minimal production cost).

This can include the movement and storage of raw materials, work-in-process inventory, finished goods, and end to end order fulfilment from the point of origin to the point of consumption.

Supply Chain Management deals with how supplies are transformed into goods and distributed to the customers. Supply Chain Management is all-encompassing, while procurement exists to support it with the input it needs to work.

Supply Chain Management is the efforts applied to optimizing activities across relevant supply chains, including, but not limited to:

- Minimizing Costs,

- Capturing Value,
- Maximizing Revenues,
- Ensuring the entire process of producing goods or services functions seamlessly from the point of production to delivery to the marketplace or end-users, and,
- Ensuring operational activities run as smoothly as possible, eliminating conflict and friction.

Supply Chain Management is the art of managing all the relevant factors from procuring relevant inputs for production, to delivering your products or services to your customers or end users as efficiently as possible.

The introduction of the supply chain concept, and its associated “Supply Chain Management” concepts, affects business operations and has extended the notion of inter-organizational collaboration to an unprecedented level. It has urged companies to look beyond their internal operational activities and more seriously consider commercial relationships with both their upstream and downstream clients and suppliers emphasizing the importance of in the exchange of relevant information.

If information about any relevant supply chain is accessible to an organization engaged in a supply chain, they then have the ability to optimize their entire supply chain activities. This will result in better planning and improved efficiencies in overall production and distribution of an improved final product. This should lead to better sales and improved overall financial results for the organization.

The primary objective of Supply Chain Management is to fulfill customer demands through the most efficient use of resources, including distribution capacity, inventory, and labor. Various aspects of optimizing the supply chain include liaising with suppliers to eliminate bottlenecks; sourcing strategically to strike a balance between the lowest material cost and transportation, implementing just-in-time techniques to optimize manufacturing flow; maintaining the right mix and location of factories and warehouses to serve customer markets; and using location allocation, vehicle routing analysis, dynamic programming, and traditional logistics optimization to maximize the efficiency of distribution.

The successful implementation over recent decades of Supply Chain Management practices has resulted in a new type of competition in the global arena, where competition is no longer isolated to company-versus-company strategies, but rather takes on a supply-chain versus supply-chain form across an industry.

In theory, a supply chain management team seeks to match demand with supply in such a way to maintain only a minimal volume of inventory; thereby minimizing the costs of financing and improving the internal rate of return on funds employed. The result has been a “just in time” approach to management of inventories for both inputs and manufactured outputs.

However, recent disruptions in supply chains and bottlenecks in transportation and logistics arising from 2020 through 2023, have many organizations rethinking their priorities as “security of supply” has become a greater risk issue.

The term "logistics" applies to activities within one business or organization involving product distribution, whereas "supply chain" additionally encompasses manufacturing and procurement, and therefore has a much broader focus as it involves multiple enterprises (including suppliers, manufacturers, and retailers) working together to meet a customer need for a product or service.

B. Differences between Procurement and Supply Chain Management

To restate the previous; "procurement" is the process of acquiring the supplies you need to run your business operations in the creation of goods or services, while "Supply Chain Management" includes how these supplied inputs are transformed into finished products or services and delivered to the marketplace or customer.

In short: ***"Procurement focuses on inputs, while Supply Chain Management includes both procurement of inputs, as well as distribution and delivery of outputs to the customer."***

Here is a comparison of key responsibilities:

Procurement	Supply Chain
Research markets	Oversee procurement of inputs and raw materials
Create a Purchase Requisition	Receive and warehouse goods from supplier
Short-list suppliers and assess supplier performance	Initiate and monitor pace of manufacturing
Negotiate price, terms and conditions	Facilitate distribution of manufactured goods
Create a Contract or Purchase Order	Facilitate warehousing manufactured goods at wholesalers and retailers.
Expedite and confirm receival of the ordered goods	Oversee sales of manufactured goods and pace of sales
Receive and confirm Invoice and authorize payment	Confirm product availability to customers
Establish and maintain supplier relationships	Establish and maintain supplier and customer relationships

Procurement has a focus dealing with acquiring input supplies and services. In another sense, procurement can be seen as a subset of the wider macrocosm of the supply chain and exists as a branch of Supply Chain Management as it assists in securing the inputs required to be processed into finished products.

Procurement exists as a significant support function within the operational activities of a business and is essentially concerned with ensuring the constant flow of input supplies into organization for production and processing into finished products.

Procurement activities may emphasize building supplier relationships and managing them to ensure they can be leveraged to deliver the input supplies and services to the organization as it facilitates production.

Supply Chain Management is often more output-oriented, focusing on what is required to move products and services to the customers as efficiently as possible.

An example of this would be a feed mill which is acquiring feed grains, protein meals and other feedstuffs for the manufacturing of livestock feed.

Supply Chain Management would include the procurement function, as well as the storage, warehousing and distribution of the final feed produced to the marketplace, livestock producer, or final end user consuming the feed.

In essence, Supply Chain Management deals with how inputs are transformed into goods and services, and then distributed to the customers.

Considering the insights mentioned in the table above, we can understand three key factors:

- Procurement exists as a subset of Supply Chain Management;
- Procurement supports an organization's activities by providing the inputs required to run day-to-day operations related to production;
- Supply Chain Management focuses more on how these inputs are transformed into finished goods and delivered to the customer.

C. Similarities between Procurement and Supply Chain Management

Despite the differences, both procurement and Supply Chain Management are quite similar in many ways:

- Within the supply chain both the procurement of inputs and the management of outputs must be proactively managed in concert with each other in order to support the efficient operational activities of the organization.
- Both are core responsibilities that must remain within the organization's internal operational functions and are likely to require input from external stakeholders.
- Both Procurement and Supply Chain Management assist in delivering the organization's strategic business goals and objectives.

D. Building Trust and Relationships with Suppliers

Many organizations are structured so that people work in small, flexible teams for specific sourcing responsibilities. These teams are designed to leverage individual competencies and strengths in the best way possible, while delegating greater responsibility to those with more experience.

As an organization, it is important to develop a trusted working relationship with your suppliers that is supported by open and timely communications.

Suppliers can also be a readily available source of market intelligence and information. Agile procurement organizations often address collaboration challenges by working face-to-face with their business stakeholders. Together, they can work to capture value by insight and expertise into shared projects and solving revenue and cost challenges through an open dialogue with professionally talented individuals within the procurement and operational team,

A supporting relationship of successful business activities will then quickly become an effective way to build trust-based partnerships. For suppliers, this means investing in the quality and certainty of supply for products in order to achieve sustainable costs and optimize the value in the products supplied.

Enhancing the supplier relationship and establishing a history of a successful working relationship enable the procurement function and suppliers to communicate more effectively.

V. Least Cost vs Value-Based Procurement - Differentiation of Inputs

Procurement is often the primary touchpoint within the organization for the production of the goods and services being procured. As such, procurement teams are best placed to generate value in the entire value chain of goods and services.

In a perfect world an organization would have unlimited opportunity to select inputs from a variety and diversity of inputs. When considering product formulization, a wide variety of inputs at a range of prices can be considered from the input menu. However, the physical world will likely place significant limitations on the number and volume of inputs that can be effectively utilized operationally.

When considering value procurement, a range of product selection decisions will need to be made prior to the purchase of the input material and their subsequent timely delivery to the processing location.

Capturing "value" can be both a challenging as well as a highly complex effort for an organization. For procurement teams to justify and validate the value they create, they need to break down the barriers and let strategic discussions focus on creating value generation instead of cost savings. In this way the organization's management team will be able to build insights and understanding that can be applied to create a more open, valuable, and simplified approach to generating procurement value.

In order to maximize value across your business activities it is important to clearly define your objectives.

For example; **is my objective to be a least cost producer, or is my objective to maximize value of my end product.**

Other value-generation opportunities may also exist through better managing the overall supply chain end-to-end.

For Example: Let's assume we are an integrated poultry producer who manufactures our own feed, as well as finishing out broilers in a poultry enterprise. One of the key input ingredients is likely to be soybean meal (SBM), which may have originated from a number of competing sources. In the formulizations of the various feed rations, are the differences in origin of digestible protein and amino acid profile being adequately considered…?

Soybean Meal is not just Soybean Meal…!

A. "Least Cost" Approach

In this scenario the nutritionist considers soybean meal to be soybean meal. In his least cost feed ration modeling software he carries a single feed ingredient for soybean meal. For this ingredient he carries the likely minimum nutritional value for energy, the amino acid profile, and other import nutritional factors.

This is quite an acceptable approach, as you do not want the resulting feed to be deficient in any of the restrictive nutritional factors.

While the resulting feed is likely to perform to expectations, this approach does not maximize the value potential of the possible range of ingredients, in this case soybean meal.

Operationally this approach simplifies activities as all SBM receivals are placed into a single ingredient bin and do not require operational differentiation.

Accounting likes this approach because simplifies and reduces the number of ingredients in the inventory list that must be maintained into a single ingredient.

Procurement and purchasing performance KPI (Key Performance Indicator) can be simplified as a single ingredient category making comparative assessment of least cost procurement a simple task. The result is that average actual costs can be compared to actual market values over a specified period of time.

B. Least Cost "Value" Approach

In this scenario the nutritionist considers each source of SBM to be a unique SBM ingredient.

In his "least cost" feed ration modeling software the nutritionist carries a number of feed ingredients for SBM, each carrying a unique nutritional profile and value for energy, the amino acid profile, and other import nutritional factors.

This approach allows each source of SBM to be assessed on its own unique quality characteristics and corresponding value as the feed ration is formulated.

However, it is important to note here that with this approach a greater level of management is required as quality factors are managed to a finer tolerance and must be more closely monitored to avoid a potential deficit in any of the restrictive nutritional factors.

The resulting feed can be expected to perform to expectations, just as the previous scenario. However, using this approach is likely to result in a lower cost for inputs as the value potential of each possible range of ingredients is maximized.

Operationally this approach complicates activities as SBM receivals must be segregated by quality or origin and placed into separate ingredient bins. Furthermore, feed manufacturing activities and formulation must be adjusted as available sources of ingredients wax and wane.

Accounting will likely want to avoid this approach as it significantly increases the number of ingredients in the inventory list that must be maintained.

Procurement and purchasing performance will become increasingly complicated as a range of possible ingredients must now be individually assessed based on value rather than just costs. This will further complicate what was previously a very simple performance KPI as multiple unique ingredient categories must be compared across a relative value matrix. This is very likely to result in "push back" from both the procurement manager and the accountant.

This issue highlights the frequent occurrence of individual KPI's not aligning with overall group objectives.

C. Product Differences Due to Processing – Soybean Meal

A byproduct of vegetable oil manufacturing obtained by extraction from soybean seed (Glycine max (L.) Merr.), soybean meal (SBM) is the most important protein source used in the formulation of livestock feed. It is a product of the extraction of soybean oil from soybeans.

The feeding value of SBM is unsurpassed by any other plant protein source, and it is the standard to which other protein sources are compared. It represents two-thirds of the total world output of protein feedstuffs, including all other major oil meals and fish meal. [xv] This includes feed formulation for aquaculture, beef, dairy, pork, and poultry, as well as pet food.

Several crushing processes exist for soybeans and other oilseeds, each of which can result in different quality of products. In solvent-extracted SBMs, the oil content is typically lower than 2%, while it exceeds 3% in mechanically-extracted meals.

SBM is typically classified by its crude protein content. Generally, there are two primary categories of SBM:

- "Conventional" Soybean Meal – 43% to 44% protein, with 7% Crude Fiber, obtained from dehulled seeds, with reintroduction of the hulls. This product has a low content in residual oil that results from mechanical pressure followed by solvent extraction. It should contain about 43.5% (as fed) of protein.
- "High-Protein" Soybean Meal – 47% to 49% protein, with 3% Crude Fiber, obtained from dehulled seeds, with partial reintroduction of the hulls. This product has a low content in residual oil that results from mechanical pressure followed by solvent extraction. It should contain about 48% (as fed) of protein.
- "Full Fat" Soybean Meal – is produced by using the whole soybean and running it through a heating and cooking process. The heating is required to destroy the anti-nutritional trypsin inhibitor. However, care is required as to not prolong the heat treatment or let the temperature rise too high, as this can destroy the nutrients within the meal. The resulting "Full Fat" SBM contains high levels of oil/fat and is also a good source of protein.

D. Product Differences

Each type and quality of SBM will vary in its intrinsic nutritional value, the primary factor of which is protein. The quantum to be considered is not only the CP (Crude Protein), but more importantly the (DP) Digestible Protein, as well as the makeup of the underlying Amino Acid profile. This can vary greatly by type and quality, as well a by point of origin, each of which should be specifically considered.

Depending on the species of animal being fed, and whether it is a mono-gastric or ruminant, as well as its state in production (weaning, growing, finishing, or gestating) nutritional requirements will vary considerably.

As such, when formulating a feed, the nutritionist will select a set of ingredients that meets the underlying nutritional requirements, while also minimizing the cost of the feed.

The following abridged INRAE-CIRAD-AFZ Feed Tables demonstrates the diversity in protein, energy, and amino acid profiles that can be realized in soybean meal.

INRAE-CIRAD-AFZ Feed Tables

	Soybean Meal oil 5%-20%			Soybean Meal oil < 5%, 46% protein + oil			Soybean Meal oil < 5%, 48% protein + oil			Soybean, Whole, Toasted (Glycine max (L.)		
Main Constituents												
Parameter	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**
Dry matter	93.2	100	%	87.7	100	%	88	100	%	88.5	100	%
Crude protein	43.8	47	%	43.5	49.5	%	46.2	52.6	%	35.8	40.4	%
Crude fat	8.9	9.5	%	1.7	1.9	%	1.5	1.8	%	19.7	22.3	%
Gross energy (kcal)	4710	5050	kcal/kg	4090	4660	kcal/kg	4140	4710	kcal/kg	5020	5670	kcal/kg
Pigs												
Parameter	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**
DE growing pig (kcal)	4020	4320	kcal/kg	3460	3940	kcal/kg	3520	4000	kcal/kg	3820	4310	kcal/kg
ME growing pig (kcal)	3730	4000	kcal/kg	3170	3620	kcal/kg	3220	3660	kcal/kg	3590	4050	kcal/kg
NE growing pig (kcal)	2450	2630	kcal/kg	1970	2240	kcal/kg	1980	2250	kcal/kg	2660	3010	kcal/kg
Poultry												
Parameter	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**
AMEn cockerel (kcal)	2840	3050	kcal/kg	2260	2580	kcal/kg	2300	2610	kcal/kg	3200	3620	kcal/kg
AMEn broiler (kcal)	2720	2920	kcal/kg	2220	2530	kcal/kg	2260	2560	kcal/kg	3410	3860	kcal/kg
										1.3	1.5	g/kg
Amino Acids												
Parameter	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**	**As fed**	**On DM**	**Unit**
Lysine	27.2	29.2	g/kg	27	30.8	g/kg	28.8	32.7	g/kg	22.2	25.1	g/kg
Threonine	17.1	18.3	g/kg	16.8	19.1	g/kg	17.7	20.1	g/kg	14.4	16.3	g/kg
Methionine	6.3	6.7	g/kg	6.2	7.1	g/kg	6.6	7.5	g/kg	5.2	5.8	g/kg
Cystine	6.7	7.2	g/kg	6.7	7.7	g/kg	7.3	8.2	g/kg	5.3	6	g/kg
Methionine + cystine	13	13.9	g/kg	13	14.8	g/kg	13.9	15.7	g/kg	10.5	11.8	g/kg

Source: INRAE-CIRAD-AFZ Feed Tables - https://www.feedtables.com/ [xvi]

(A more detailed set of information set forth in the previous table, which also includes additional types of SBM can be found in the Section XII of this paper, or on-line at: https://www.feedtables.com/*.)*

When formulating feed rations, a range of SBM types based on processing methods can be considered as a possible ingredient. Each will have a differing Crude Protein (CP), Metabolizable Protein (MP), and Amino Acid Profile (AAP), depending on the type of processing and quality of SBM.

Note: in the previous table setting forth nutritional values for various types of SBM; CP ranges from 40.4% to 52.6 % on a Dry Matter (DM) basis, with Lysine ranging from 25.1 g/kg to 32.7 g/kg DM, and Methionine ranging from 5.8 g/kg to 7.5 g/kg DM.

"Depending on the feed formulation requirements and underlying price relationships, the most economical classification type and quantity of soybean meal to be used may vary."

Particularly for the formulation of both swine and poultry rations, and to achieve the best animal performance, it is most economical to balance these rations on the basis of amino acid profile. A particular focus is given to Lysine and Methionine, which are most commonly limiting amino acids in a balance feed ration. Cystine and Threonine are also frequently given specific consideration.

The amino acid profile of SBM can vary significantly based on the method of processing, by the location of origin and production (both regionally within the United States, as well as internationally), as well as by seasonal variation. As such, the expense of testing each supply of SBM to obtain its amino acid profile can result in the more economical formulation of various feed rations and significant improvement in animal performance.

Even small differences in the processing of soybeans can result in material differences in the nutritional quality, and the resulting value of the protein meal. As such, its nutritional profile, and the meal's intrinsic feed value will vary by processing plant.

TYPE / QUALITY PRICE RELATIONSHIPS

In the market, demand for a product such as soybean meal (SBM) variations in type and quality are determined by variations in price.

The following table shows indicative SBM values for US FOB Container values in June of 2023; note however, prices may vary greatly.

Product Type	Description	Relative Value
"High-Protein" Soybean Meal	47% to 49% protein, with 3% Crude Fiber, obtained from dehulled seeds	US$500/st
"Low-Protein" Soybean Meal	3% to 44% protein, that contains the seed hulls	US$470/st
"Full Fat" Soybean Meal	Produced by using the whole soybean and running it through a heating and cooking process. Heating is required to destroy the anti-nutritional "trypsin" inhibitor. The resulting "Full Fat" SBM contains high levels of oil/fat and is also a good source of protein.	US$560/st *st = Short Ton, i.e. 2,000 lbs

*These indicative SBM values for US FOB Container values in June of 2023; however, price may vary greatly.

These prices are based on quality relationships determined by the market, and are influenced by supply and demand relationships determined by various market traders and end users. These prices for SBM, like most agricultural commodities, are highly variable across a wide seasonal price range, and can be negotiable across a number of suppliers.

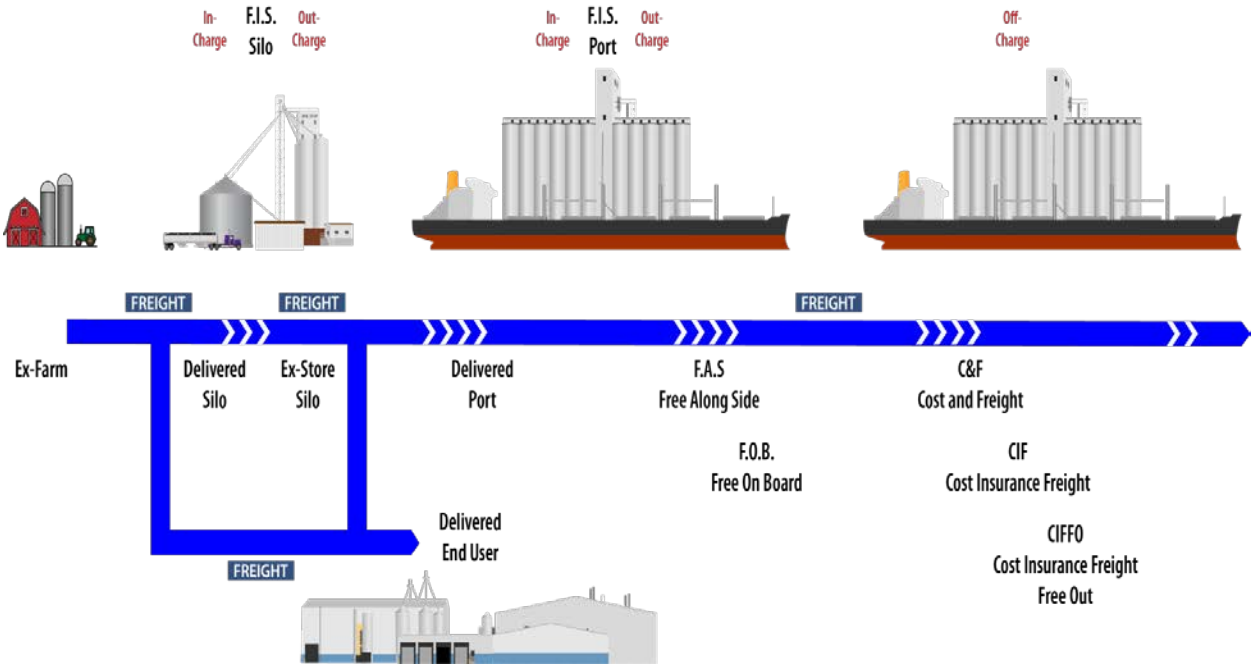
To effectively manage the procurement of a commodity the organization's procurement manager must:

- Understand what range of types and quality the organization is capable of utilizing in its operational processes to produce the desired product with the appropriate quality characteristics, and;
- Be able to determine and apply a set of quality premiums and discounts for each crucial quality factor that a commodity might possess.

E. PRODUCT DIFFERENCES DUE TO ORIGIN - GEOGRAPHICAL SPACIAL RELATIONSHIPS

Spacial relations are defined by distance. The value of this relationship is quantified by the cost of transportation, as well as any additional trans-loading, handling, and storage charges which may be incurred as the commodity moves through the bulk handling supply chain.

SUPPLY CHAIN STOCK MOVEMENT



Source: International Grains Program, Kansas State University 2022

Common international Pricing Points from countries of origin, and P.R. China for soybeans and soybean meal:

- CIF NOLA
- US Center Gulf, FOB
- US PNW, FOB
- US East Coast, FOB
- Brazilian, FOB
- Argentina, FOB
- C&F China
- Other origins...

The above diagram shows the movement through the supply chain of bulk commodities, such as soybeans or soybean meal, from farm or processing plant, to its final destination at either domestic or international end users.

Transportation for agricultural bulk commodities typically commences from farm or point of production via road truck. Subsequently, more efficient modes of transportation may be utilized, such as road, rail, intermodal, river barge, or ocean vessel. At each point along the supply chain where the mode of transportation is changed, trans-loading must occur. This process incudes additional handling and storage charges.

As the commodity travels a spacial distance from farm and closer to the end user, value is added to the inventory as it moves closer to its final destination. Any residual value remaining above transportation and other associated costs can be considered to be merchandising profit.

Other variables impacting nutritional quality of SBM can be identified by geographical location of production, as well as variability in seasonal growing conditions. In the case of soybeans, variability by regional and country of origin can be seen in oil content, energy content, crude protein levels, and the profile of amino acids.

Many manufacturing and process companies are well aware of these regional and seasonal differences, and how they can impact the value of the final products. As such, many will make an effort to seasonally originate soybeans from geographical areas that are producing a more favorable quality of soybeans.

One 2016 study by P. García-Rebollara, L. Cámaraa, R.P. Lázaroa, C. Dapozab, R. Pérez-Maldonadoc,G.G. Mateosa, explains these variations in nutritive value. [xvii]

> "The chemical composition, protein quality and nutritive value of commercial SBM is dependent on the country of origin of the soybeans. SBMs from USA showed better uniformity and had less fibre, more soluble sugars and higher indispensable amino acid content per unit of CP than Brazil SBM, with SBM from Argentina being intermediate. The USA SBM had higher TIA, KOH and PDI but lower HDI than the Brazilian SBM. All this data suggests that the quality of the protein and nutritive value of meals were higher for the USA meals than for the Brazil and Argentina meals. When the data was analysed independent of the origin of the beans, the r coefficients among chemical variables were significant in many cases, but the values depend on the country of origin of the soybeans. The most important significant correlations observed were for sucrose that was positively related to stachyose and negatively to raffinose and NDF. When the data were classified by the country of origin of the beans, negative correlations between CF and CP content were detected for the Brazil and Argentina meals, but not for the USA meals. In addition, the relation between CP and Lys (% CP) of the SBM was negative for the USA meals but not significant for the Brazil and Argentina meals. Similarly, numerously significant correlations among protein quality indicators were observed, but the r values varied widely depending on the origin of the meals. This survey explains SBM constituents in detail and demonstrates that significant differences exist in the composition and nutritive value of SBM from different origin. Feed mills should be aware of these differences when the nutritive value of commercial SBM is estimated." [xviii]

As the process of moving product from one location to another does not happen instantaneously, there is always a component of "time" or "temporal" value which must also be considered. This value can be either positive, (when the market is in a "carry" structure), or negative, (when the market is in an "inverse" structure).

For example: This may typically be from road truck to train or barge, from train to barge, or from train and barge to ocean vessel.

F. Other Considerations

Operational Limitations

Operationally there will be physical limitations to the number and volume of inputs that can be utilized at a single operational location. These limits are typically restricted by the number and

volume of available product segregations. Limitations will be determined by the number of suitable storage bins, as well as the corresponding volumes of available bin space.

As such, management decisions will need to be made in the selection of the number and variety of inputs to be kept available to be utilized in processing at a particular location.

If the value of increasing the operational capacity of storing a volume and/or variety of input materials at a particular location can deliver an economic return, additional capital expenditure to increase warehousing volumes and segregated bin space may be justified.

Administrative Limitations

From an administrative perspective, there will be a preference to keep the range and number of potential inputs at a minimum. Each additional type and variety of input product will need to be accounted for in the organization's inventory ledger, along with an associated cost of goods and a periodically calculated mark-to-market value.

Administratively, accountants prefer to take a "minimalist" approach, keeping the number and variety of input materials to a minimum. This helps to keep the supporting work and effort to a minimum.

However, maintaining an administrative system listing a wide range of potential inputs for frequent consideration by product formulators is much less expensive than the capital expenditure typically required to physically segregate and store the actual physical commodity.

In an effort to maximize input diversity and supply chain flexibility, organizational leadership should encourage organizational management to maintain as broad an input menu as deemed reasonably feasible.

VI. MARGINAL REVENUE TO EQUAL MARGINAL COST

"When it comes to operating a business, overall profits and losses matter, but what happens on the margin is crucial!"

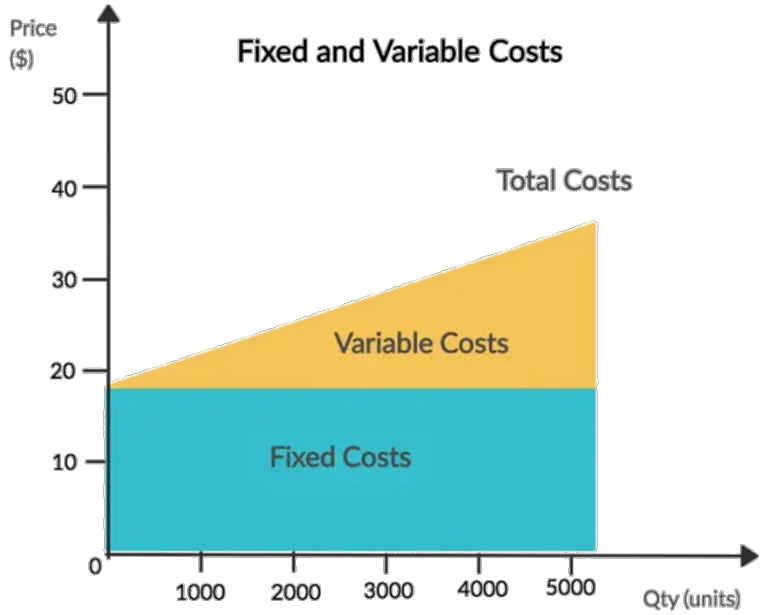
The **"Marginal Costs" of production and "Marginal Revenue"** are economic measures used to determine the volume of output and the price per unit of a product that will maximize profits.

An economically rational business always seeks to achieve as much profit as it can without taking on excessive amounts of risk. Looking at the relationship between Marginal Revenue and Marginal Costs of production can help to identify opportunities to increase profitability, and to define at what optimal economic point this is likely to occur.

"The profits are maximized when Marginal Costs are equal to Marginal Revenue."

A. CALCULATING MARGINAL COST OF PRODUCTION

Total Production Costs include every expense associated with making a good or service. They can be further broken down into: Fixed Costs and Variable Costs.



FIXED COSTS

Fixed Costs refer to those costs of business expenses that are fixed in nature, as in they do not change with an increase or decrease in the quantity of goods and services produced or sold.

Fixed Costs are commonly related to recurring expenses that do not change with varying production levels, i.e., they are not directly related to production. It includes such items as; salaries, building and rental payments, equipment costs, interest payments, and insurance.

Fixed costs are relatively stable over time as the ongoing varying costs of operating a business are not dependent on changing production levels.

Variable Costs

Variable costs are those directly related to and vary with production levels. It includes such items as; the costs of input materials and packaging, costs of operating machinery in the production process, shipping of product, warehousing and storage costs, sales commissions and retailing / marketing expenses, and any other costs that vary with the process of production.

Total Costs of Production

Total Production Costs include all the expenses, both fixed and variable, of producing products at current levels.

Calculating Marginal Costs

Knowing their marginal costs is important in managerial economics as when taken together with marginal revenues, they help businesses understand how to maximize their profits. The marginal cost (MC) is computed by dividing the change (Δ) in the total cost (TC) by the change in quantity produced (Q). From an applied perspective, marginal cost is calculated by dividing the change in total cost by the change in quantity produced in countable, discrete units:

$$\text{Marginal Cost} = \frac{\text{Change in Total Cost}}{\text{Change in Quantity}}$$

MC= ΔTC / ΔQ

where:

- **MC = Marginal cost**
- **ΔTC = Change in Total cost**
- **ΔQ = Change in quantity**

Example A: A company that produces 100 tonnes of feed with a Total Production Costs for all 100 tonnes of $65,000. The Average Cost of Production is: ($65,000 ÷ 100 tonnes = $650/tonnes).

However, the Marginal Cost of production is the cost of producing just one more additional unit. The total cost of producing 101 tonnes of feed for $65,700.
The Average Cost of Production is now: ($65,700 ÷ 101 tonnes = $650.50/tonnes);
while the Marginal Cost for producing the 101st tonne of feed is: ($65,700 - $65,000 = $700).

The marginal cost of production may change as production capacity changes. If, for example, increasing production from 200 to 201 units per day requires a small business to purchase additional equipment, then the marginal cost of production may change and become much higher. In contrast, marginal costs might decline significantly if the business is considering an increase from 150 to 151 units using existing equipment – given the "batch" approach to some of the production processes, and the associated sharp increase in total cost per change in unit produced that would occur from the "step up" in production costs.

A lower marginal cost of production means that the business is now operating with a lower total cost for each additional unit of production. If the marginal cost of production is high, then the cost of increasing production volume by an additional unit of output is also high. As a result, increasing production may or may not be in the business's best economic interests.

B. Calculating Marginal Revenue

Marginal revenue measures the change in the total revenue that occurs when one additional unit of a product is produced and sold.

How do you calculate the Marginal Revenue?

Marginal revenue (MR) is calculated by dividing the change in total revenue by the change in total output quantity. Therefore, we can look at each additional item sold from a Marginal Revenue perspective.

For instance, a firm may sell 100 units of product for $70,000, at an average price of $700 per unit. If the 101st item then sells for $700; then, its MR is also $700. As a result, the average price of $700 is ignored for this last unit of sales, with MR only looking at the next unit sold, or the incremental change. *(This is a common situation in a competitive market where the Marginal Revenue curve is flat…)*

From an applied perspective, marginal revenue is calculated by dividing the change in total revenue by the change in quantity produced and sold in countable, discrete units:

$$\text{Marginal Revenue} = \frac{\text{Change in Revenue}}{\text{Change in Quantity}}$$

MR= ΔTR / ΔQ

where:

- **MR = Marginal Revenue**
- **ΔTR = Change in Total Revenue**
- **ΔQ = Change in Quantity**

Example B: Suppose a business produces 100 tonnes of a product per day and is able to sell the product at a price of $700 per tonne. In this case, the total revenue is $700 x 100 mts, or $70,000. The total revenue is calculated by multiplying the price by the quantity produced.

Alternatively, the total revenue from producing 110 tonnes is $77,000.

The marginal revenue per tonne across all units produced and sold is calculated as also $700, or ($77,000 - $70,000) ÷ (110 – 100).

(This is a common situation in a competitive market where the Marginal Revenue curve is flat…)

How Can Marginal Revenue Increase?

Marginal revenue increases whenever the revenue received from producing one additional unit of a good grows faster, or shrinks more slowly, than its marginal cost of production. Increases in marginal revenue may also occur if market prices for the finished goods also increase.

If marginal revenue is increasing it is a sign that the business is producing too little relative to consumer demand. In this situation, the business could sell more of the product if it produced more. In other words, there are profit opportunities to benefit from if production and sales were to expand.

Example C: Let's say a business manufactures chicken feed. At the current level of production, it costs the business $650 in materials and labor to produce its 100th tonne of chicken feed. At current market values, that 100th tonne of chicken feed sells for $700 per tonne, meaning the profit for this last tonne of chicken feed produced is $50 per tonne.

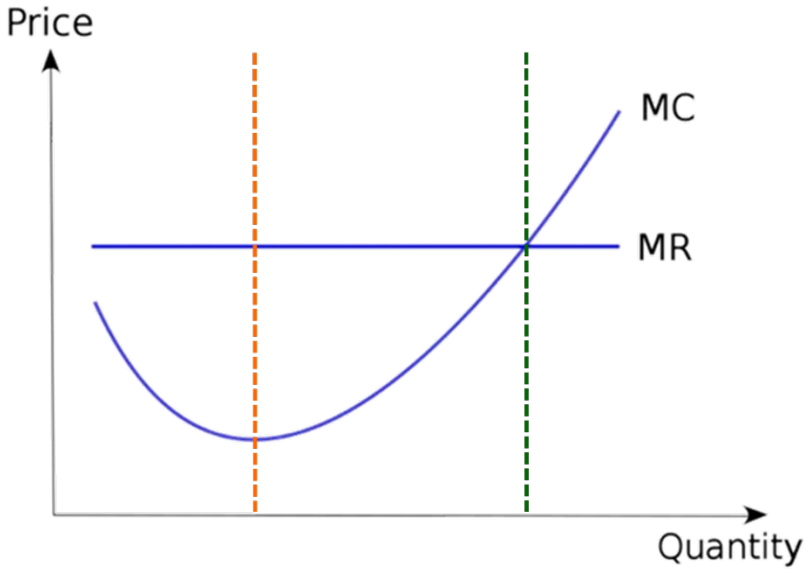
Now, suppose the 101st tonne of chicken feed produced also costs $650 per tonne, but under new market conditions this 101st tonne of chicken feed can be sold for $725. The profit for the 101st tonne of chicken feed is now $75 per tonne, which is greater than the profit for the 100th tonne of chicken feed of $50 per tonne.

This is an example of increasing marginal revenue.

C. Reaching Optimum Production

At some point, the business reaches its optimum production level, the point at which producing any more units would increase the per-unit production cost. In other words, additional production causes both fixed and variable costs to increase.

When marginal costs equal marginal revenue, we have what is known as profit maximization. This is where the cost to produce an additional unit of goods is exactly equal to what the business earns from selling it. In other words, at that point, the business is no longer making money.



- Least Cost Procurement: MC < MR
- Value Procurement: MC <= MR

As we can see from the above marginal cost curve, marginal costs start decreasing as the business benefits from economies of scale. However, marginal costs can start to increase as companies become less productive and suffer from diseconomies of scale. It is at this point where costs increase and they eventually meet marginal revenue.

For example: Increases in production beyond a certain level may involve paying prohibitively high amounts of overtime pay to workers, or, the maintenance costs for machinery may significantly increase. Other possible reasons for increasing marginal costs may be the result of the organization becoming too large and as a result, inefficient. The cause may also be a business managerial issue in which staff become demotivated and less productive. Whatever the reason may be, businesses may face rising costs and will have to stop production when the revenue they generate is greater than the marginal cost of production.

MARGINAL ANALYSIS

The above calculations are part of a technique called "Marginal Analysis", which breaks down inputs and outputs into measurable units. First developed by economists in the 1870s, it gradually became part of business management, especially in the application of the cost-benefit method, which involves the identification of when marginal revenue is greater than marginal cost, as explained above. [xix]

The tool most frequently used is known as a "Cost-Benefit Analysis" or a "Partial Budget Analysis". Partial budgeting is an analytical tool for determining the impact on profitability of a marginal change in production and/or costs. It is also a method for analyzing operational changes of an organization.

According to “Cost-Benefit Analysis” principles, a business should continue to increase production until marginal revenue is equal to marginal cost. [xx] If the level of optimal economic output is where the marginal benefit is equal to marginal cost, then considering cost-return rules is irrelevant to your decision. So marginal analysis also tells managers what not to consider when making decisions about future resource allocation: They should focus on marginal costs and returns in their decisions rather than average costs, fixed costs, and sunk costs.

Example D: A feed manufacturer could try to measure and compare the costs of producing one more tonne of feed with the projected revenue from its sales.

Suppose that, on average, it has cost the business $650 to make a tonne of feed. The average sales price over the same period is $700 per tonne.

However, from a marginal cost versus marginal benefit perspective, this doesn't necessarily mean that business should manufacture one more tonne of feed.

If 100 mts of feed were previously manufactured, then the business should only consider the cost and benefit of the 101st tonne of feed.

If it will cost $701 to make the 101st tonne of fee, but will only sell for $700 per tonne, the business should stop production at 100 tonnes.

THE BOTTOM LINE

Production and manufacturing businesses frequently monitor Marginal Production Costs and Marginal Revenues to determine ideal production levels. The Marginal Cost of Production is generally calculated whenever production levels change. This allows businesses to determine a profit margin and make plans for becoming more competitive to improve profitability.

This is an important component in corporate governance and revenue cycle management. The best business leaders understand this, anticipate changes, and react quickly as the business environment changes.

PARTIAL BUDGET ANALYSIS [xxi]

Organizations frequently must make decisions about operational changes that are being considered. Many of the decisions are incremental, such as expanding or reducing operational capacity, changing ingredients in a feed ration, or analyzing the impact in livestock productivity. A useful exercise in approaching such a problem is a partial budget analysis.

A partial budget analysis will help managers evaluate the full financial impact of incremental changes.

For example: When considering an integrated feed and livestock producer, **whereas least cost feed ration formulization only takes into account changes in costs, an approach using a partial budget analysis will take into account changes in revenue.**

A partial budget will only consider the changes in input resources, as well as expected changes in the output products being produced.

A partial budget analysis does not consider the resources in the business that are left unchanged.

Only the points under consideration for evaluation are the changes (increase or decrease) to both revenue and costs in the particularly activity.

Principles of Partial Budgeting [xxii]

Partial budgets are based on the principle that small changes have a financial impact in one or more of the following four areas:

Revenue	**Costs**
1. Increase in Revenue	3. Increase in Costs
2. Reduction or Elimination of Costs	4. Reduction or Elimination of Revenue
Net Changes in Revenue	**Net Changes in Costs**
Grand Total	

A partial budget analyses consists of two components; with the left hand column containing items that increase revenues or reduce costs, while the right hand column contains items that increase cost or reduce income. The net impact will be the positive financial changes minus the negative financial changes. The subtotal for each component / column is then added together for a grand total. A net positive indicates that income will increase due to the change, while a net negative indicates that changes will reduce income.

This process or decision tool may be easily setup and prepared in a spreadsheet or accounting ledger.

Partial Budget Analysis Components

1. Increases in Revenue

This section lists all increases in revenue expected due to the changes being considered. Items to include here might be increases in product sales revenue, increases in livestock performance, and other positive impacts to income and revenues.

2. Reduction or Elimination of Costs

This section lists all decreases or elimination of expenses and costs expected due to the change being considered. These costs could be reductions or total elimination of certain expenses.

3. Increases in Costs

This section lists all increases in expenses and cost expected due to the change being considered. Most of these will be new costs of inputs or production cost for the changes under consideration. This list may also include non-cash costs such as labor and depreciation.

4. Reduced or Elimination of Income

This section lists all decreases or elimination in revenues expected due to the change being considered. Items to include here might be reductions in product sales revenue, decreases in livestock performance, and other negative impacts to income or revenues.

It is important to use realistic estimates for the changes under consideration, using realistic input costs, yields, product quality and prices.

When deciding on a projected prices and values, use best estimates from the current market forecasts for where and when the input is to be sourced or production is most likely to be sold.

Income increases may come from expansion of production capacity. If the expansion is minor, current production quantities, quality and average prices are reasonable approximations to use. But if the expansion is large, during the early production periods lower yields and quality may result due to start-up difficulties. Keep this in mind when estimating changes in income.

Accurately estimating some of these factors can be difficult and challenging. As such, it may be beneficial to make estimates for three scenarios, including; a best case (i.e. high), worst case i.e. low), and most likely expected outcome.

Over or under estimation may lead to incorrect decisions and possibly reduced financial performance when the expectations for the change was meant to improve it.

Partial Budget Analysis Summary [xxiii]

Summarization of the above four partial budget components is the last step in partial budgeting analysis.

Each of the two factors impacting Revenue and Costs are summed to obtain a subtotal line. The two subtotals are totaled (added income/reduced cost and subtract increased costs/reduced income) to arrive at a projected net return from adoption of the change under consideration.

A negative number indicates the change as considered will reduce income, while a positive number indicates that the change will be profitable.

MARGINAL REVENUE VS. MARGINAL BENEFIT

Although they sound similar, “marginal revenue for the **seller**” is not necessarily the same as the “marginal benefit to the **consumer**”. In fact, it's the flip side when one accounts for the principle of declining marginal benefits from consuming a good.

While marginal revenue measures the additional revenue a business earns by selling one additional unit of its good or service, marginal benefit measures the consumer's benefit of consuming an additional unit of a good or service.

Marginal benefit represents the incremental increase in the benefit to a consumer brought on by consuming one additional unit of a good or service. It normally declines as more of a good or service is consumed.

Example E: Consider a hungry consumer who wants to buy a cheeseburger. They go to a local restaurant and purchase a cheeseburger for $10.

Since they have now satisfied their initial hunger, they would not need or necessarily want to purchase a second cheeseburger for $10. They might, however, be enticed to purchase a second cheeseburger for $5, since this is perceived as incredible value at this price.

Therefore, the marginal benefit to the consumer decreases from $10 to $5 with the prospect of purchasing and consuming an additional unit in the form of the second cheeseburger.

Tying the two concepts together, let's go back to Example A. Let's say a customer is contemplating buying 100 tonnes of feed. If the marginal benefit of purchasing the 101st tonne of feed $600 per tonne, and the feed manufacturing company is willing to sell the 101st tonne of feed to maximize its consumer benefit, the marginal revenue to the business would be $600 per tonne and the marginal benefit to the consumer would be $650.

(In this case the feed manufacturing company is willing to stand a $100 per tonne loss on the 101st tonne in an effort to maximize customer benefit.)

VII. Building a Coordinated Value-Based Procurement Strategy

A value-based procurement strategy captures the economic value from existing quality traits of inputs to deliver the required value traits stipulated the customer and for which they are willing to buy at premium price.

If the customer is not willing to pay a premium for a particular quality or trait in a product, they are then telling you the trait contains no economic value.

In an effort to deliver a value-based product to the market, an organization aligns all of its stakeholder's efforts around the defined value proposition, delivering value for money, along with continuous improvement and drive for innovation.

It is common practice for an organization to divide operational activities into specialized functional areas of responsibility: i.e., Product Design & Formulation, Procurement & Purchasing, Primary Manufacturing & Production, Secondary Production, Sales of the Final Product, Accounting Finance & Administration.

Some of these areas will operate internally, such as Product Design & Formulation, Primary Manufacturing & Production, Secondary Production, Accounting Finance & Administration. While others, such as Procurement & Purchasing and Sales of the Final Product, will heavily engage external supply chains. Often in an effort to reduce complexity, these areas of responsibility are further subdivided by product family or by geographical location.

Those responsible for a product family can rarely work in isolation from other product families, as there are often numerous potentialities and serious issues arising associated with logistics, transportation, warehousing and storage, along with availability of manpower, and so on.

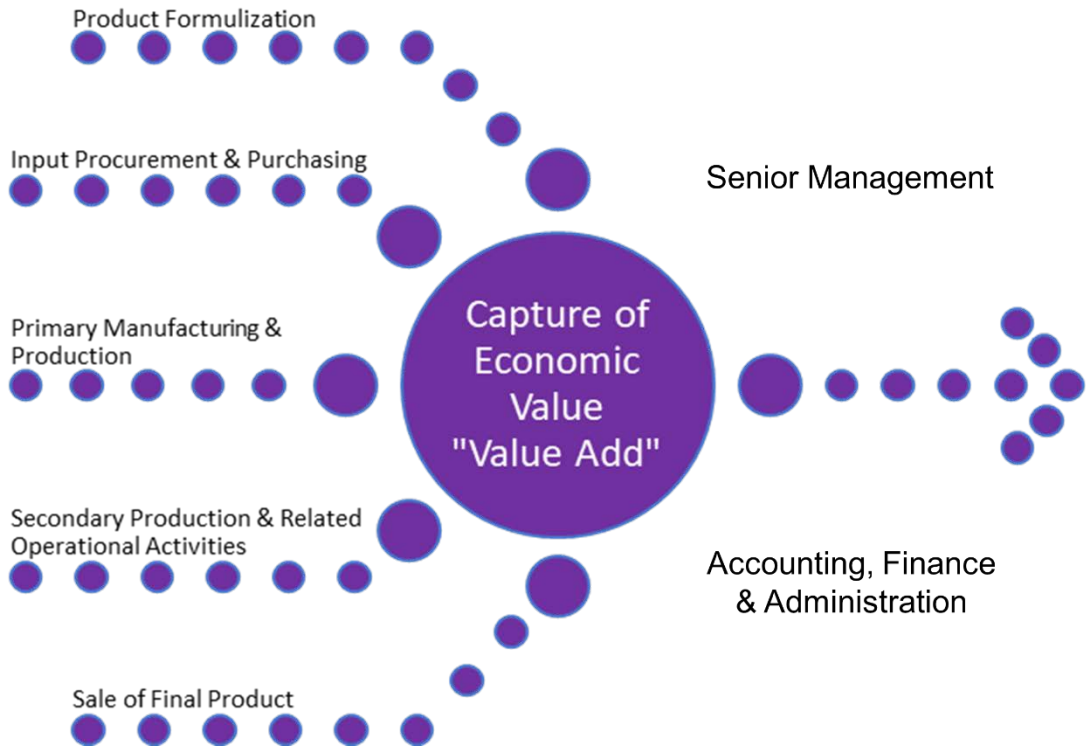
Nevertheless, it will be necessary to better understand the behavioral aspects and the range of activities that occur in day-to-day operational activities, and in the management of related supply chains. What will be necessary is the capacity to effectively communicate, striving to better understand the needs and objectives of stakeholders and customers. Most importantly, learn to listen. This is the cornerstone to ensuring a successful outcome.

A. Coordination of Organizational Activities

A value-based procurement strategy must undertake a coordinated business approach. The coordinated approach allows the organization to consider longer-term goals, such as achieving and maintaining highly competitive supply chains which are architected through effective supplier selections and managed through leading supplier relationship management processes.

To achieve the objective of value-based outcomes that maximize economic returns, the procuring "value" inputs that will result in "value" outputs must be coordinated across business activities. Areas of activity include, but are not limited to:

- Senior Management
- Product Formulation
- Input Procurement & Purchasing
- Primary Manufacturing & Production
- Secondary Production & Related Operational Activities
- Sale of Final Product
- Accounting Finance & Administration



In order to establish a coordinated business model, established goals and objectives must be aligned across a number of business activities.

B. Collaboration and Working with the Management Team

In collaboration with the management team, it is important to identify who in the group is responsible for the financial outcomes and results, as well as the budget. Once this is clearly understood, it becomes easier for the procurement team to have a meaningful discussion on meeting their desired goals and objectives.

As such, each product line, service or project should have a budget assigned to it. If the final cost is under or equal to the budget, their objective is achieved.

The responsible individual will want to continuously know how they are tracking against their budget. This is especially true for professional service work where progressive payments are required periodically based on the amount of completed work against the final project. They want to make sure that procurement is acting as an “enabler” for their teams, as opposed to an “obstacle” slowing down things.

In summary, there needs to be good transparency and tracking between actual expenditure against underlying budgets.

Senior Management

While a “value” based business model is likely to generate higher operating margins and increased bottom line profits, the approach requires increased coordination between various activities of the organization, such as procurement, operations, sales, accounting and administration, with leadership from the senior manager team, and directed by the GM or CEO.

Product Formulation and Design

Product formulation and design will determine what inputs will be required to manufacture the intended product, and by extension, the associated supply chains that will support them.

Broadly speaking, the success of a product depends on product formulization and design, along with the capabilities of the associated supply chains. As such, inclusion of these decision makers will be paramount to creating a value-based procurement strategy.

In the case of feed manufacturing, it is usually the nutritionist, in the process of feed formulization, who has the capacity to determine the comparative marginal costs for the next unit of energy, or protein, or a specific amino acid.

When formulating a feed ration, the nutritionist should calculate the marginal cost, as well as the marginal revenue (i.e. marginal value) for each of the limiting nutritional factors in the ration.

They will also need to consult with the manufacturing or production manager to understand any potential impacts on manufacturing costs (or potential savings). These will need to be taken into consideration when completing the Marginal Revenue vs Costs calculations.

If the organization activities include integrated livestock production, the Operations Manager for the secondary activity or sales person should be consulted to determine agreement on the marginal revenue (i.e. marginal value) that could be produced.

These considerations will then need to be communicated to the Procurement Manager, and discussed to determine at what values the desired input can be purchased.

Procurement & Purchasing

To assure the success of a value-based procurement strategy, the Procurement & Purchasing Manager will need to continually communicate the range of values for potential inputs.

Procurement and purchasing must not only directly consider the requirements of the type and quality specifications of the commodity, but also the potential impact on transportation, quality, quantity, production schedule, manufacturing, production technologies, production policies, regulations, and other legal considerations.

This should not only include the current “spot” price of a commodity, but also its forward value, such that the formulation of feed to be manufactured at some point in the future can use appropriate relative values.

They must also have a working understand of what the “value” is likely to be for the next unit of energy, or protein, or a specific amino acid. This will provide them with the capacity to determine potential marginal value of a commodity with variations in its quality specifications.

This collaboration on the incremental economic value of quality factors becomes increasingly important if procurement wishes to establish a set of quality premiums and discounts for a particular commodity which is being purchased.

Procurement and Sales are no different except for the focus. Procurement professionals do not have to become a sales professional, but they must think like one when dealing with both internal and external stake-holders.

A value-based procurement strategy is one that identifies how to maximize value for the business in both the short- and long-term perspective.

Effective procurement managers will not only conduct comparative price and value analysis, along with production process discussions involving strategic suppliers, and in depth supply chain analysis. They should also be a key participant in the optimization of business models, be closely involved in audit processes, and participate in strategic product development discussions.

Procurement teams deal with a range of different stakeholders and customers, each of whom have different challenges, needs and expectations. It is essential to better understand these and to strive to build a strong working relationship with your stakeholders. What will be necessary is effectively communicating with the organization's stakeholders to better understand their needs and objectives. Most importantly, "learn to listen." This is key to ensuring procurement success.

If what you offer can help your internal customers and stakeholders achieve their goals, then you have achieved the alignment required to ensure that procurement is being perceived as a "value-add" partner within the organization.

It is a common complaint that procurement doesn't have a seat at the management table. What is not often heard is what is required to get a seat at the table. If procurement value is only quantified as cost savings, or a "least cost" approach; then, senior management will only call when there is increasing pressure to reduce costs.

However, if procurement activities can consistently present a "value-add" proposition and is considered to be a sound advisor across organizational activities, then management is likely to encourage procurement to be involved in organizational activities early on, and then require them to deliver the value procurement outcomes on budgeted targets.

You can't hope that one day your organization will understand the value of procurement, you must proactively sell the value of procurement internally to your organization. As the saying goes, **"Hope is not a strategy"**.

So how can procurement work to satisfy the differing needs of various stakeholders?
– Keep it simple!

Procurement is expected to provide a simple and clear process for purchases to be facilitated. The simple expectation from customers (external or internal) is that the procurement and purchasing process is simple, easily communicated, and easy to follow.

A follow-up to this is a simple purchasing experience so that users do not have to jump through hoops to place an order.

Think of the times you yourself might have cringed when asked to fill out a form for what you perceived to be a simple request that then became an exhausting and complicated process. The

same is true for procurement and purchasing. The expectation is for an easy, simple, uncomplicated, and less time-consuming process.

Primary Manufacturing & Production

The manager of primary production and manufacturing activities must also be included in discussions concerning value-based procurement, formulization and design strategy. The primary concerns of the manager of manufacturing and production will impact on the costs (or potential savings) which may be realized in relation to operational activities.

The success of a product depends on its inputs and manufacturing processes. Product "value" impacts not only cost, production processes and efficiency, final product quality, but also the generation of demand.

For example, a change in feed ingredients may impact the time or energy requirements, as well as total capacity, in the manufacturing of a tonne of feed. These considerations will then need to be communicated to the Formulator and Procurement Manager, and taken into consideration when completing the Marginal Revenue vs Costs calculations.

Secondary Processing, Production & Related Operational Activities

Similarly, in a vertically integrated organization, a value-based procurement strategy will require input from the manager of secondary processing, production and other related operational activities.

At this level, the primary concerns will be any impact (cost or benefit) which may be realized in relation to these secondary activities.

For example, in a vertically integrated feed and livestock production organization, the potential impact on livestock production performance due to changes in feed quality will need to be carefully.

These considerations will then need to be communicated to the Formulator, the Procurement Manager, and the Manufacturing and Production Manager for inclusion in the calculations of Marginal Revenue vs Costs calculations, as well as consideration in the purchasing of alternative inputs.

To this extent, an organization's internal manager of secondary processing, production, and other related operational activities, should be considered as an internal customer.

Sale of Final Product

Sales and procurement are no different except for the focus. In sales, the focus will primarily be on generating revenue. To maximize this effort sales is concerned with understanding the customer and their differing needs and requirements, the differing challenges each face, and their differing personas (both organizationally and individually).

Strategically, the sales team try to formulate a potential solution and align the offer of goods or services to meet the customer's requirement and needs to resolve a problem.

When selling externally, the value an organization delivers to a customer is in effectively assisting them to reach their goals and objectives. In a similar fashion, procurement is selling the value to the internal customer in assisting them to achieve their goals and objectives.

It is important to note here, in conversations with customers, either external or internal, the focus should be kept on the value proposition, not just costs and savings objectives. If this is where the conversation begins and ends, achieving the full value of the transaction is quickly lost.

Often in a particular situation, cost savings might not be the ultimate goal. The real underlying issue and concern may be the need for faster turnaround time for the required input. It is in this need where the value proposition lies. The challenge is to quantify the value in this requirement, and then relate it back to the solution that is able to be provided.

Accounting, Finance and Administration

To establish a successful coordinated value-based procurement strategy, it is essential that the Accounting, Finance and Administration team fully embrace the approach. Not only do they administrate and record the financial activities of the organization, but they will also be responsible for calculating any established performance measures used to determine success.

Based on how strong the relationship between Procurement Team and Accounting, Finance and Administration Team maybe, the opportunity for effective collaboration can vary drastically. If a strong relationship has been developed, then collaboration becomes increasingly important as the Accounting, Finance and Administration team is depending on the procurement team to keep them aware of the impact procurement activities are creating so that they can appropriately adjust budgets and financial forecasts.

In contrast, if the appropriate exchange of information and collaboration does not exist, and the Accounting, Finance and Administration Team is working in an isolated, siloed environment, and does not receive the most current information; then, budgets and financial forecasts cannot be adjusted on a timely basis to more accurately reflecting the current financial situation.

For example; if procurement is negotiating a deal with a supplier which significantly reduces the input cost of a major feed ingredient, then the Accounting, Finance and Administration Team needs this information so that the budgets can be adjusted accordingly.

Too often we see Procurement Teams struggling to highlight the value they can bring to the organizations due to a lack of collaboration with the Accounting, Finance and Administration Team about current purchasing activities and prevailing market values of key inputs.

The procurement and purchasing function can deepen its engagement across the business with an effort to raise awareness of how additional savings can be generated through collaborative approaches, along with how these savings might be reflected in the organization’s P&L and other financial statements.

In addition, the perceived impact of differing reporting methodologies in accounting for revenue generation and/or cost savings can vary greatly. This can result in a large perceived difference between area performances demonstrated in its bottom-line financial statements. This in turn will ultimately drive individual and organizational activity.

For example, procurement and business teams can collaborate more closely during product development to maximize value from sourced inputs, as well as to minimize single-source dependency.

Even if all the cost savings or increased revenue generation are not reflected in the organization's financial statements, collaboration is still valuable for incentivizing productive behavior by stakeholders.

C. What is Value Procurement?

To begin with, "Value Procurement" needs to be defined so that there is a clear understanding of what is brought to the organization through these efforts.

The value proposition of procurement needs to be clearly understood across the organization's senior management team in order for the procurement manager to have sufficient input into the organization's decision-making process.

Value Procurement can be defined by four areas:

1. Cost Savings

Supply chain and procurement and purchasing managers are under constant scrutiny to secure the best pricing for their resources, which becomes a difficult task when faced with the inherent lack of transparency.

Cost benchmarking helps to identify competitive pricing within the industry but benchmarking across a range of supply chain performance factors has been recommended as a best practice.

This is the "least cost" approach to the purchasing of inputs which drives cost savings across the organization as it is delivered by procurement. By "cost savings", it is being referred to as hard savings on purchases against current market values.

2. Revenue Generation

"Value" is best represented in the organization's capacity to generate revenue.

Rules for success in business – Rule No. 2:

"Focus on revenue generation rather than costs…" – Brian Tracy [xxiv]

There is a greater opportunity in any value-based organization to increase revenue, as compared to reducing costs. However, this requires increased coordination across suppliers and internal stakeholders extending beyond negotiated line-item costs alone.

3. Performance

Measuring supply chain, procurement and purchasing performance is not a new practice. Most organizations measure at least some aspect of their supply chain, procurement, and purchasing activities. The key is to match the most appropriate measures to the organization's unique business requirements, and to have them align across areas of responsibility with the organization's goals and objectives.

However, with the abundance of options for potential performance metrics that can be used, this effort is seen as a challenge for many organizations. One approach is to relate multiple measures

in a hierarchical structure so that interdependencies and the contribution of multiple indicators to the key or most significant metrics can be seen more easily.

Three key indicators of a well-functioning supply chain are:

- **Accuracy of Sales / Demand Forecasts:** This refers to the difference between forecasted sales / demand and actual sales / demand. The capacity, in combination with the ability of a supply chain to respond to changes in demand, is one of the most significant factors. The agility of a supply chain functions as a predictor of successful execution and delivery throughout the chain.

- **Cost and Sales Benchmarking:** This approach helps to identify how successful the organization was at capturing competitive pricing within the industry. This measure should include supply chain costs, combining all sourcing, production, distribution, and customer service costs.

  Supply chain and Procurement and Purchasing managers are under constant scrutiny to secure the best pricing for their resources. This becomes a difficult task when faced with the inherent lack of transparency. However, an organization does not want to use this as the only measure to evaluate purchasing activity. While a relatively easy and effective way to measure point of delivery costs for agricultural commodities, the approach can quickly deteriorate into an over-riding "least cost" approach to the purchasing of inputs as it drives cost savings across the organization as it is delivered by procurement.

- **Order Fulfillment:** This measures orders, *(both purchases and sales),* which are complete, accurate, on time and in good condition.

  Performance criteria should include measures based on incentive-based supplier performance, such as; inventory reduction strategies, service level improvements, as well as strategies that build in supply redundancy and alternative paths for sourcing.

4. Compliance

Compliance refers to compliance with the organization's purchasing policies and procedures. The policies are generally required to meet statutory requirements as part of SOX compliance (Sarbanes-Oxley Act) [xxv] or identified by accounting best practices and statutory requirements.

5. Diversification

There is an inherent risk associated with relying on a single major supplier, or customer. Many organizations establish a strong relationships with one major supplier, or one major supply chain partner, or one large customer or geographical market.

Many organizations recognize the need to manage risk by diversifying both their suppliers, as well as their customers. This requires a deliberate effort in identifying alternative trading partners and actively seeking a broader list of suppliers, as well as alternative customers, markets, transport and logistics providers.

The outcomes can create a more diversified and strengthened supply chain with greater potential for risk and cost mitigation in the future.

6. Risk Management

There is a wide scope of risks that need to be managed by any organization. The approach to these risks can vary significantly by organization to organization. This can range from Price Risk, to Security of Supply, to Quality risks.

The following is a list of 20 risk areas that should be considered by any organization procuring bulk agriculture commodities as a major activity. Depending on the industry sector, this could be a significant “value-add” opportunity for procurement.

1. Contractual Performance Risk
2. Physical Commodity Price Risk
3. Physical Commodity Market Liquidity Risk
4. Commodity Futures Price Risk
5. Options on Commodity Futures
6. Basis Risk
7. Time Spread Risk
8. Quality Spread Risk
9. Intra-Commodity Spread Risk
10. Foreign Exchange Risk
11. Financial Liquidity Risk
12. Financing and Interest Rate Risk
13. Credit Risk
14. Operational Risk
15. Freight and Transportation Risk
16. Storage Risk
17. Character and Reputational Risk
18. Legal Risk
19. Statutory and Legislative Risk
20. Sovereign Risk

7. Resilience

Supply chain resilience is, "the capacity of a supply chain to persist, adapt, or transform in the face of change and potential disruption".

For a long time, the interpretation of resilience in the sense of engineering resilience prevailed in supply chain management, leading to the notion of persistence. A popular implementation of this idea is given by measuring the time-to-survive and the time-to-recover of the supply chain, allowing identification of weak points in the system.

More recently, interpretations of resilience have adapted a sense of ecological resilience, and by extension social–ecological resilience. This has led to the notions of resilience possessing characteristics of adaptation and transformation, respectively. As such, a supply chain is now being interpreted by some as a social-ecological system, not dissimilar to an ecosystem in nature (e.g., forest), with the ability to constantly adapt to changing environmental conditions and transform itself into a fundamentally new system as the market conditions require.

This new approach to resilience can lead us to a panarchical interpretation of a supply chain as a system embedded into a system. This view allows analysis of interactions of a supply chain with broader systems that operate on other levels, whether they be societal, political economic, or environmental.

For example, these components of resilience can be considered in the context of the events in 2021 and the Suez Canal obstruction, when a ship blocked the canal for several days, or the extremely destructive Category 4 Hurricane Ida that made landfall at the port of New Orleans, shutting down export activity.

- **Persistence** means to bounce back. In the example of considering the Suez Canal obstruction, it is about removing the ship as quickly as possible to allow a return to "normal" operations.

- **Adaptation** means to accept that the system has reached a "new normal" state and to act accordingly. Again, in the example of the Suez Canal obstruction or Hurricane Ida, this can be implemented by redirecting ships around the African cape or by redirecting exports to alternative ports, respectively.

- **Transformation** means to question the assumptions of globalization, outsourcing, and linear supply chains and to consider other alternatives. This could lead to local and circular supply chains.

Organizations can also build greater agility and resilience into their procurement, purchasing and supply chains by working with service providers who can provide additional capabilities. This often takes the form of additional support services. These can take the form of technologies supporting procurement planning, inventory management, trading systems, and other analytical capabilities. Suppliers are often in a position to assist in providing inventory financing or variable cost solutions, which can provide increased flexibility and better cost control. These efforts can assist in capturing “value”.

Developing resilience in an organization begins with procurement and purchasing activities. Organizations should focus on building a network of trusted vendors (customers, supply chain partners, and suppliers) that can assist in managing disruptions and support business continuity.

Cultivating a resilient supply chain implies that the organization can better at plan, anticipate, and react to unexpected events by enabling collaboration with its suppliers.

8. Growth, Innovation and Strategic Thinking

Procurement activities can present a significant opportunity for growth, innovation, and strategic thinking. To be successful, procurement must work collaboratively across the organization, fully understanding the strategic objects, and being able to bring ideas and approaches into discussions with senior management.

A few examples include procurement’s ability to:

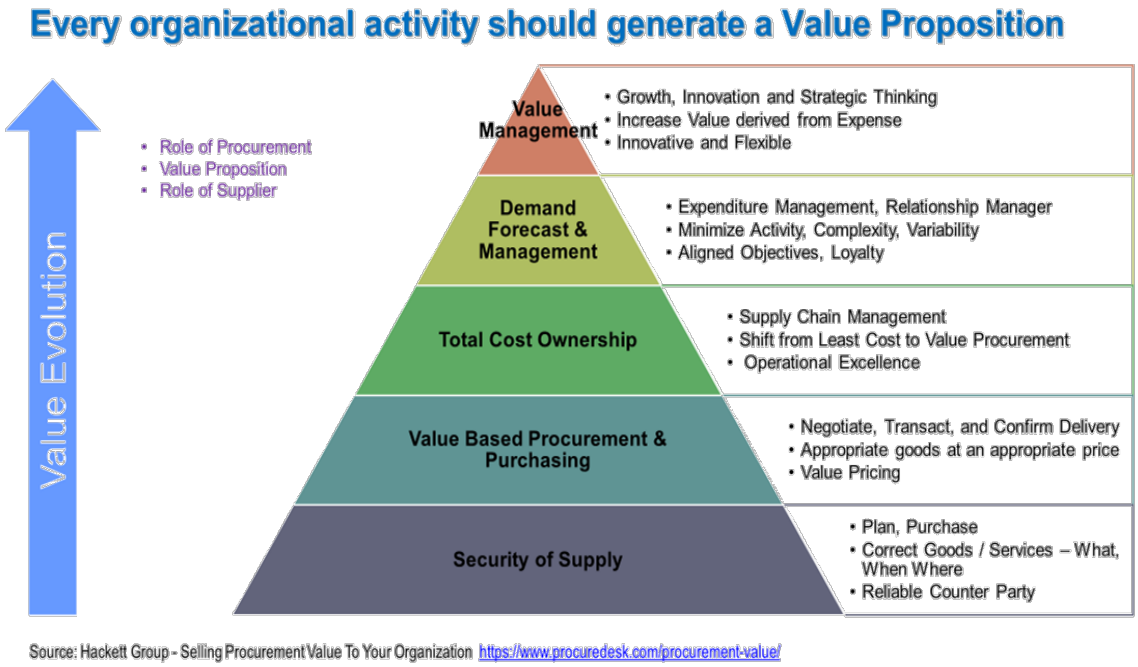
- Develop new suppliers who can help reduce overall cost or develop new unique products;
- Find and secure new sources of supply which can drive sustainable growth for the company;
- Develop methods that effectively manage adverse risks, while opening opportunities to increase favorable risks that increase opportunities to increase value or profits;
- Evolve strategic thinking in opening and engaging new markets.

D. VALUE EVOLUTION

Only a finite amount of savings can be extracted from cost savings. Once the procurement and purchasing function of an organization has evolved to this level, they need to look at additional approaches to add value across organizational activities. This can only be achieved through an increase in revenue, which is theoretically unlimited. There is a greater opportunity in any value-based business to increase revenue, as compared to reducing costs.

"Experience shows us that when savings are achieved by procurement through properly sourced product from reliable suppliers, additional gains will tend to diminish sharply."
– Guy H Allen

However, to move to the next level requires an increase in coordination across suppliers and internal stakeholders extending beyond negotiated line-item costs alone. At this point, procurement needs to establish itself as less of a buyer/negotiator and more of an expert and change agent for its external suppliers, its internal customers within the organization, as well as within the business activities overall. Each area and level of the organization must demonstrate an increase in their strategic value proposition and contribute value in areas beyond just purchase-price reduction.



Source: Hackett Group - Selling Procurement Value To Your Organization https://www.procuredesk.com/procurement-value/

In the figure above from the Hackett Group [xxvi] the organization is divided into five levels, each of which has an opportunity to add additional value through their activities and to the process. These include; Security of Supply, Value-Based Procurement & Purchasing, Total Cost of Ownership (TCO), Demand Management, and Value Management.

Rules for success in business – Rule No. 1:

"Always choose higher quality over lower costs…" – Brian Tracy [xxvii]

The above statement by Brian Tracy would imply there is a significant greater opportunity to increase revenue by producing a premium quality product than producing a lower quality least cost product. However, to produce a premium product, the manufacturer must start with inputs containing those desired quality traits that will be contain in the final quality product.

For example: A feed manufacturer can produce a monogastric livestock feed that satisfies the minimum crude protein requirements. However, they can also produce a quality monogastric livestock feed with a balance amino acid profile the meets the minimum protein requirements. This feed with a balanced protein content will more likely result in better performance of the livestock, and therefore be able to attract a greater price premium in the market.

E. Measuring Value Impact

The question will soon arise: How do we measure the value and impact of your procurement activities? How do we know if you are getting the best return on your investment? Are we missing opportunities to improve our performance?

Let us take a closer look at some of the key concepts and methods for measuring procurement value and impact, and how they can be applied.

Value Procurement

Simply put; Value Procurement is the difference between the costs and the benefits of procurement activities.

Costs of procurement is where most organizations start and stop, as focus and attention is given to “least cost” procurement. Costs can include measures such as price, time, resources, risks, and negative externalities.

On the other side of the equation are benefits. Benefits can include such measures as savings, compliance, quality, operational efficiencies, innovation, sustainability, and increased customer satisfaction and value (i.e., sales price).

The scope in which costs can be managed is limited and finite, while the upside to the scope to which benefits can be managed is theoretically unlimited.

The value of procurement can be measured at different levels of organizational activity, such as; transactional, operational, tactical, and strategic.

For example:

At the **Tactical** level, measures can be assessed against short term objectives. This often takes the form of improving the quality of both inputs and the resulting products, reducing lead times, and increasing flexibility in delivery terms for goods and services. Tactical procurement activities typically include effective contract management, with a focus on achieving cost savings and operational efficiency. Tactical procurement activities can be relatively easy to measure, and the benefits are frequently realized more quickly. However, a purely tactical approach to procurement may lead to missed opportunities, a lack of long-term relationship-building with suppliers and may not encourage innovation. It often does not address the larger issues of risks lying within a supply chain.

At the **Transactional** level, measures can be assessed against the price and quality of each purchase or sales transaction. This often takes the form of a “least cost” approach to procurement, or maximization of the “per unit value” of sales.

At the **Operational** level, measures can be assessed against improvements in operational efficiencies by either lowering the per-unit costs of labor, energy, etc., or by increasing gains in productivity and yield, such as pounds of feed fed per weight of meat produced, value of feed fed per value of live animal produced, etc.

At the **Growth, Innovation and Strategic** level, measures can be assessed with how closely procurement activities align with your organizational vision and mission. Strategic procurement activities take a longer-term view optimizing supplier relationships, reducing risks, and driving innovation, as well as effectively managing risk exposures to the organization across the supply chain.

Strategic procurement can also include such issues as environmental, sustainability, social responsibility, and responsible corporate governance. Strategic procurement activities often require a significant investment of time, resources, and expertise, with the resulting benefits not being immediately apparent.

The key to successful procurement is to understand the differences between the approaches listed above. It involves clearly defining the organization's strategic goals, risk tolerances, and understanding current supply chain complexity, from which the procurement team can make informed decisions which best suit the organization's objectives.

To assist senior management and a board of directors in decision making and providing clear direction, it is important for the organization to responsibly and clearly assess a ROI (Return on Investment) or “cost vs benefit” measures for each of the issues that are being addressed, and to avoid applying an abstruse measure that cannot be clearly understood.

TECHNICAL SPECIFICATIONS VS CONSIDERATION OF PERFORMANCE

It is critical for procurement and purchasing managers to understand the technical specifications and requirements of customers as well as internal stakeholders.

It is wise to frequently ask the question; “Do they need a specific item, or do they need an item to do a specific job? And why...?”

The answer to this can have a significant impact on value of procurement. It can influence the way in which goods and service are procured. It can also have an impact on associated activities, such as the impact that good or service may have on other organizational processes, or just looking at the specification from a different perspective, or is there an opportunity to generate additional value elsewhere in value chain. There may be an opportunity to capture additional value through increased productivity or reduction in waste, reducing costs to the business.

F. WORKING WITH THE SUPPLIER

Your relationship with your suppliers is paramount to a successful procurement strategy.

Suppliers can be a unique resource, providing market insight, product knowledge, and industry experience. Often the creativity of suppliers can be used for the benefit of both the supplier and the organizations.

For example**:** Suppliers can be a readily available source of product information, as well as how these inputs can be utilized to improve production process efficiency and costs. As many products have been through extensive testing and field trials, these results are often made

available. Also, suppliers are often the best source of advice on how a product may be most effectively integrated into the organization's operational manufacturing of production activities.

In addition, suppliers are often aware of current events and market activities that may affect the supply and price of their products. This information can be significant when planning procurement and purchasing activities.

Suppliers can assist in synchronizing the seasonal delivery supplies when they may be more readily available at advantageous pricing, immediately contributing to an improved costing and organization bottom line.

Furthermore, suppliers can be a source of recommendations on cost reduction and quality improvement across their related component of the supply chain and their product seasonal lifecycle.

Suppliers may also be able to provide additional insight to the organization's development of a successful product marketing strategy and ability to generate greater revenue. This creates a "Win–Win" situation for both parties.

An intuitive supplier has a vested interested in the long-term financial success of the organization.

ENVIRONMENTAL, SOCIAL, AND CORPORATE GOVERNANCE (ESG)

Environmental, Social, and Corporate Governance (ESG), also known as environmental, social, governance, is a framework designed to be embedded into an organization's strategy that considers the needs and ways in which to generate value for all organizational stakeholders (such as employees, customers, suppliers, and financiers).

As part of an effort to demonstrate ethical practices, many organizations are integrating codes of conduct and other guidelines into their corporate cultures and management systems. Through these extended efforts, organizations are placing demands on their suppliers, including facilities, farms, subcontracted services, etc., and verifying that they are complying with these efforts and required standards through social audits.

A lack of transparency in a supply chain may limit consumers' knowledge and understanding of where their purchases, or inputs used to manufacture goods may have originated, as well as the socially irresponsible practices surrounding these inputs.

Practices in this area are still evolving, as well as the public requirement and acceptance of such an approach. More recently, some efforts have been met with increasing resistance or a negative market response. A recommendation would be to proceed with caution, unless the full impact of any approach can be clearly determined.

In any situation these added requirements will add a cost. Most buyers remain reluctant to pay a premium for supplies with these additional requirements.

One possible outcome is that many of these ESG requirements become embedded in regulatory requirements. However, unless a market-driven model can be developed, the eventual success of these efforts will remain questionable.

VIII. ALIGNMENT OF PERFORMANCE MEASURES AND INCENTIVES

Within any organizational activity it is important to keep all team member focused on the same goals and objectives. It is not productive to have individual team members working counter to the overall group objectives.

As such, both individual incentives and group incentives have a similar goal; to drive the appropriate performance and outcomes so that the organization's goals and objectives are most likely to be achieved.

For an organization to determine the best approach to incentivizing human resources, they must first clearly establish their goals and objectives, and ensure these are understood by each individual and are within their ability to have a material and measurable impact.

A. PERFORMANCE INCENTIVES

GROUP INCENTIVES

Group or team incentive schemes are based on collective performance. This approach is most effective when all group members have some impact on the resulting outcomes.

- A group incentive scheme is the easiest approach to incentivize collaboration and teamwork.
- Subsequent rewards can be distributed equally, proportionally, or differently for each member.
- It is this type of management approach that works best when establishing an organizational value-based approach.

To be successful, the incentive scheme must take into account an understanding of group dynamics. Individuals within the group need to be highly motivated self-starters, team players,

and not prone to absconding responsibilities to others. Management must be sure to avoid contrasting motivational forces.

INDIVIDUAL INCENTIVES

Individual incentive schemes are based on the individual meeting work-related performance standards, such as productivity measures, quality measures, customer satisfaction, safety, or attendance. This approach is most appropriate when:

- performance outcomes can be measured objectively;
- the individual has control and impact over the outcomes;
- the incentive scheme does not create misaligned incentives that may create counter-productive and unhealthy competition that are not in line with the organization's overall goals and objectives,

Generally, (depending on the organizational and individual activities), individual incentive schemes are not a substitute for good management and in assuring high organizational performance. They do not incentivize collaboration and teamwork.

Individual incentive schemes require continuous monitoring, and more frequent periodic reporting. It is very easy for established incentives to become misaligned and counterproductive.

That said, individual "spot bonuses" may be effectively used to give recognition or show appreciation for a job well done. A spot bonus can be utilized to reward an individual for achievement over and above expectations, finishing projects early, contributing new ideas, developing new skills, or obtaining licenses. Typically, a spot bonus is given as a one-time payment at the discretion of management. This approach is most prevalent among non-executive positions.

B. MEASURES AND KEY PERFORMANCE INDICATORS

The value and impact of any procurement activities on the organization should be clearly understood. The impact can be positive or negative, direct or indirect, tangible or intangible, and short-term or long-term.

DEFINING PROCUREMENT VALUE AND IMPACT OBJECTIVES

Before we can measure our procurement value and impact, we need to define:

- The challenges and opportunities in your market and industry;
- The needs and preferences of our internal and external customers;
- The needs and preferences of our internal and external suppliers;
- The organization's goals and priorities;
- The function of procurement;
- Management's expectations and objectives.

In order to accomplish this, tools as SWOT can be used to analysis, stakeholder analysis, and assessment of the value proposition to identify and prioritize your procurement objectives.

Once you have defined our objectives, we will need to select appropriate measures to track and evaluate our procurement performance. It is important to develop measurable outcomes from these activities. The impact of procurement activities can be measured by using metrics, establishing indicators, and other frameworks that capture the resulting outputs and outcomes from procurement.

Selected measures should be relevant, reliably assessed and validated, and actionable. Selected measures should also be a balance of quantity and quality measures. An effort should be made to avoid overloading the process or system with too many complex measures.

Procurement value and impact measures can be in the form of:

- **Benchmarking** - the practice of comparing business processes and performance metrics to industry bests and best practices from other companies. Dimensions typically measured are quality, time and cost.
- **KPI's** – (Key Performance Indicator) a type of performance measurement that evaluates the success of a particular activity within an organization (such as projects, programs, products, and other initiatives). KPI's provide a focus for operational improvement, create an analytical basis for decision making and help focus attention and prioritize issues and activities.
- **SMART Criteria** - is an acronym: Specific, Measurable, Assignable, Realistic, and Time-related. The approach assists in developing criteria in the setting of goals and objectives whose outcome is expected to deliver better results in management, employee-performance, and personal development. The term was first proposed by George T. Doran in 1981 when he suggested that goals should be SMART.

Procurement performance indicators define a set of values against procurement activities that are to be measured. There are two categories of measurements:

- **Quantitative** information is presented with a specific numeric value measured against a standard, objective or historical trends. They are not typically subject to distortion, personal feelings, prejudices, or interpretations.
- **Qualitative** information represents a non-numeric conformance to a standard, or interpretation of personal insight, experiences, opinions or feelings.

The challenge arising from the use of a 'historical indicator' is that it is descriptive or lagging, and can only measure what has happened in the past.

Any use of a measure that attempts to quantify something in a future becomes predictive, diagnostic or prescriptive, and is no longer an 'indicator'; it is now at this point a 'prognosticator'.

C. Key Performance Indicator - KPI

Key Performance Indicators (KPIs) refer to a set of quantifiable measurements used to gauge an organization's overall performance. KPIs are specifically designed to help determine a company's strategic, financial, and operational achievements, as well as to make comparison similar organizational activities within the same sector.

KPIs gauge an organizations performance against a set of established targets and objectives, as well as against industry peers. The objective of a set of KPIs is to succinctly communicate performance of activity and to allow management to make informed strategic decisions. The information analyzed may be financial or nonfinancial nature and may relate to any activity within the organization.

A good KPI provides objective and clear information on progress toward an organizational end goal. It tracks and measures factors such as efficiency, quality, timeliness, and performance while providing a way to measure performance over time.

Underpinning the approach should be an established set of clearly aligned KPI's and related measures. KPIs should have restrictions and be tied to SMART (specific, measurable, attainable, realistic, and time-bound) metrics. Vague, hard-to-ascertain, and unrealistic KPIs serve little to no value. Instead, focus on what information you have that is available and meeting the SMART acronym requirements.

To maximize organizational performance primary KPIs should be based on a holistic approach and final objectives and outcomes, being careful to avoid establishing individual reward programs that may give rise to incentives conflicting over-riding group objectives.

It is these overriding holistic KPIs which should be given primary consideration and focus in any performance review. While other KPIs may provide guidance as to problems and issues may exist, and give direction of where improvement can be made, they should not be allowed to become a priority and distract individual activity away from the organization's primary goals. They should not be allowed to become competing or conflicting activity.

By understanding exactly what KPIs are and how to implement them properly, senior managers are better able to optimize the organization for long-term success.

For example: A Feed Mill Manager's primary KPI and bonus may have been established as a measurement of "operational cost per tonne" to manufacture feed, while a Sale Manager's primary KPI and bonus may have been established as a measurement of "total net margin on sales" of feed.

It is would not be uncommon for the Feed Mill Manager to refuse to have the crew work overtime to produce additional tonnage of feed so as not to blow out his KPI of "operational cost per tonne" of feed, and thereby loose his bonus.

As a result, the Sale Manager may not be able to make the additional volume of sales, decreasing his "total net margin on sales" of feed, as well as causing the company to lose the potential revenue and profit this additional sale.

While both KPIs measure performance, this is a prime example of misaligned and conflicting KPIs

After performance measures have been determined, the information will need to be collected and analyzed. Appropriate tools and techniques should be used to process and interpret the data. It is imperative that the data and information utilized be reliable and obtained through consistent methods and sources. The data and information should also be transparent, reliable, and verifiable.

The resulting performance measures should be consistently presented with a periodic report, and in an easy-to-understand format using charts, graphs, dashboards, tables, and/or scorecards to help visualize and communicate agreed performance measures.

In addition to recognizing and rewarding group and individual achievements and improvements, the performance measures should be utilized to establish continuous feedback on performance and be the basis for continuous methods for improving group performance.

Once sufficient historical data and information has been collected, the resulting measures can also be utilized in establishing future performance targets and in drafting future action plans.

Finally, the performance measures, data and information can be used to evaluate organizational strengths and weaknesses, opportunities, and threats, as well as assisting management in gaining deeper insight from lessons learned, prioritizing the focus of future activities, determining future best practices.

Limitations of KPIs

There are some downsides to consider when working with KPIs. There may be a long time frame required for KPIs to provide meaningful data.

For example, an organization may need to collect annual data from employees for years to better understand trends in satisfaction rates over long periods of time.

KPIs require constant monitoring and close follow-up to be useful. A KPI report that is prepared but never closely analyzed serves no purpose.

KPIs that are not continuously monitored for accuracy and reasonableness do not encourage beneficial decision making.

And most importantly, if KPIs are not correctly established and aligned they open up the opportunity for personnel to “game the system”. Instead of focusing on actually improving whole of the organization’s processes and results, they may be incentivize to focus on improving KPIs tied to individual performance and bonuses. They may also promote unnecessary tension and conflict between employees.

D. Segregation of Responsibility

While it is the organization’s preference to establish group-based incentives based on collective performance that align with the organization’s goals and objectives, it is also important to firmly establish clear Segregation of Responsibilities (SOR) for each organizational area or individual.

SOR is an essential component of effective risk management and internal controls. Significant damage to your organization can result from errors or fraud. SOR assists in reducing costly risks, whether they are financial, reputational, or regulatory infractions. Appropriate SOR will also help to ensure adequate operational support. It will provide strategic focus on ‘doing things right’.

SOR emphasizes sharing the responsibilities of key business processes by distributing the discrete functions of these processes to multiple people and departments. SOR is designed to prevent unilateral actions within an organization’s workflow, which can result in damaging events that would exceed the organization’s risk tolerance. In short, no one person or group should be given control over a process or asset where they have the unchecked power to overlook errors, falsify information, or attempt theft.

SOR breaks business-critical tasks into four separate categories based on function: 1- Authorization, 2 - Custody, 3 - Recordkeeping, and 4 - Reconciliation.

SOR is recommended across all organizational areas, but it’s arguably most critical in procurement & sales, custody of goods, payment & invoicing, accounting & reporting, cybersecurity, and information technology departments.

Ideally, no single organizational area or individual will hold responsibility outside of a single category. Job roles should adequately separate responsibilities, with a system of checks and

balances so that multiple positions perform a “check and balance” regulating each other’s activities. It helps to protect the organization, as well as the individual.

Organizations failing to implement effective SOR policies do so at their own peril.

IX. MANAGEMENT'S ROLE IN COORDINATING ORGANIZATIONAL ACTIVITIES

Leadership is the art of mobilizing others toward shared goals and aspirations in an ethical manner…

Any organization's culture and strategic approach is established by the individual at the top of the organizational chart, i.e., the Chief Executive Officer (CEO), or General Manager (GM), and then subsequently by the Board of Directors.

Likewise, to establish a value-based procurement business model", it must begin with the support of organizational leadership and a commitment to drive this objective from the top. It starts by being clear on what organizational goals and objectives have been established, which is then followed by clarifying what practices are acceptable, and delineating what is "good" and what is "bad". This also includes what operational behaviors are to be encouraged and promoted, as well as what behaviors are to be discouraged.

Why does senior management need to take a leading role in coordinating "value procurement" across organizational activities?

-- It all depends upon how "value" is perceived in the organization…

In the organization, is procurement perceived as performing a value-added function collaborating with other areas across the organization, or is procurement just a mere support function whose primary activity is to create purchase orders for suppliers and ensure that the correct product is delivered on time at the correct location?

The answer to these questions will determine how the organization's management perceives the function of procurement and purchasing and will drive the resulting organizational structure and ability to add value.

If management's objective is to establish a true "strategic" value procurement organization, then they need to think beyond current perceptions of purchasing and look at the situation through the eyes of those in the organization that need to be supported and enabled. This means adopting a more thoughtful, intelligent, and agile approach to procurement – capturing value.

If procurement and purchasing are able to establish themselves as a well-respected and value-adding partner in organizational activities that successfully contributes to the bottom line, then it will be possible to build an organization with a "value-add" ethos.

Procurement managers who have traditionally measured their performance via measures of savings, will eventually face the challenge of a decline in willing suppliers, along with a loss of motivation for engagement and continued collaboration across the organization. A value-based approach opens a whole other set of opportunities for collaboration, cooperation and profit potential for both parties.

The key to successful procurement is to understand the differences between the approaches. It involves clearly defining the organization's strategic goals, risk tolerances, and understanding current supply chain complexity; from which the procurement team can make informed decisions which are best suited to the organization's objectives.

Attention also needs to be given to establishing organizational resources of time and capital, such that they can be invested in the initiatives that are most critical to the company's success. Performance measures, data and information can be utilized to evaluate organizational strengths and weaknesses, opportunities, and threats (SWOT), as well as assisting management in gaining deeper insight from lessons learned, prioritizing the focus of future activities, and determining future best practices.

Successful management of all expenditure requires a significant investment in staff, technology and very possibly change management. Any expense not under proper management represents both potential cost leakage and increased risk to the company.

The organizational approach to procurement and purchasing activities needs to become more sophisticated in converting negotiated savings and value into realized savings and value and recognizing this value in the organization's earnings before interest, depreciation, and amortization (EBITDA).

To assist senior management and a board of directors in decision making and providing clear direction, it is important for the organization to responsibly and clearly assess a ROI (Return On Investment) or "cost vs benefit" measures for each of the issues that are being addressed, and to avoid applying an abstruse measure that cannot be clearly understood.

A. Procurement Responsible to the CFO

It is common within some organizational structures to see procurement activities reporting through to the organization's CFO (Chief Financial Officer), especially when there is a need to manage and reduce costs.

CFOs are not just responsible for ensuring that the financial records are accurate, but that they reflect a true perspective of the organization, and that ownership is considered to be a "value-add" investment, as management are taking steps to grow the business.

Given the cost focus of a CFO, reducing cost comes naturally. As such, CFOs understand the value of procurement from a "cost-saving" perspective and its impact on EBITDA, as well as other financial measures. Understandably, procurement performance criteria is set up to encourage a "least cost" approach to purchasing. This approach frequently overlooks the "value" proposition that can be achieved by an effective procurement team.

In these situations, the good news for procurement is that they are likely reporting to the Finance Manager or the CFO. As such, it is reasonable to assume that collaboration with Accounting, Finance and Reporting on cost savings should not be a problem. However, the bad news is that procurement will likely need to convince senior management of the benefits of a "value procurement" approach for the organization. Either way, there will be a case to be made to highlight the value of an effective procurement function. The challenge will be to elevate the activities of procurement and purchasing to a "value" procurement model, as opposed to just a "least cost" function whose responsibility is to just process purchase orders.

B. Procurement Responsible to the CAO

It is not uncommon for some organizational structures to see procurement activities reporting through to the organization's CAO (Chief Administration Officer), or even at times to the General Counsel's Office.

In these situations, it is likely to be found that senior management considers there is a need to build compliance in string purchasing arrangements or statutory compliance, or when they might be preparing for an IPO (Initial Public Offering).

The idea of procurement and purchasing reporting these functions through to a CAO is supported by a desire to centralize all administrative and compliance functions.

Regrettably for organizations structured in the above manner, procurement and purchasing activities start to be looked like just another primary cost center required to operate the business, and not as a potential opportunity to facilitate significant value-add efforts that contribute to the bottom line.

X. CURRENT TRENDS IMPACTING PROCUREMENT, PURCHASING AND SUPPLY CHAINS

Over the past three decades, the expansion of a globalized marketplace has provided easier access to a wider variety of alternative input products, goods and services. However, with recent events coinciding with the global Covid pandemic, the outbreak of conflict between Russia and the Ukraine, deteriorating trade relations with China and the decline of globalized trade,

value procurement and purchasing, in conjunction with more effective supply chain management, is set to play a greater role in meeting future business challenges as organizational leadership searches to find successful solutions.

If recent events have taught us anything, it is that even the best of forecasts and predictions failed to anticipate a number of the major challenges the world now faces. What has occurred is that procurement activities within successful organizations have moved away from simply "least cost" purchasing to optimizing processes and becoming pivotal in solving critical business problems.

Moving forward, procurement and purchasing professionals need to be bold in embracing opportunities to capture increased value and propose supply chain solutions that help organizations navigate troubled and uncertain waters.

Each organization must decide if they are going to be a producer of a "least cost" product produced from "least cost" inputs or a producer of a "value" based product produced from "value" based inputs.

Even now, governments are placing supply chain issues at the front of their agendas. However, to be successful, organizations should not wait for regulation to begin addressing these issues.

HUMAN RESOURCES

The most important input in any organization is its human resources. Your people will be asked to complete a wide variety of tasks in a timely and competent fashion. Attracting and retaining top talent is essential for the success and growth of any organization.

With declining populations and narrowing demographics, organizations will increasingly face unprecedented shortages of labor and talent. Businesses will need to become increasingly proficient in workforce management and maximizing available talent.

To help meet these challenges of securing specialized skills and capabilities, organizations should consider utilizing additional services and support provided by existing suppliers. This can prove to be a cost effective means of increasing access to quality talent and improving productivity and resilience, while gaining flexibility.

TRANSPARENCY AND DETERMINATION OF VALUE

As market participants consolidate and integrate across the supply chain, price transparency for many commodities and goods continues to decline.

While the price of a particular commodity, such as SBM, may be readily available, the detailed break up of its value in terms quality and other pricing components may not be clearly defined. It will be the function of a skilled procurement officer to be able to break this down into its appropriate value for each component. In many organizations, commodity purchase decisions are more based on experience than based on a structured mechanism. The seasonal timing of purchases and quantity can be crucial in making these decisions.

To meet this challenges organizations are increasingly engaging a range analytics tools, software and skill sets to increase the understanding of these relationships, and better define the underlying value proposition for alternative input products.

LOGISTICS

Global logistics disruptions will continue to impact organizations as the flow of goods into key markets are temporarily restricted by unexpected disruptions in industry sectors, shutdowns of major ports, or the rise of regional conflict.

Disruption in transportation can impact ocean vessels to road trucks on their way to ports, halting movement of lengthening times in transit as cargo is diverted through alternative routes or arrival is delayed into major transportation hubs, restricting trade flows.

Major logistics disruptions create a ripple effect across supply chains resulting in supply shortages downstream, and a supply surplus upstream that soon overwhelms warehouse storage capacity.

When these disruptions occur, it is usually assumed that these after some time trade flows through the supply chains will eventually return to normal. In the interim, expect to see longer waits for retail shelves to be replenished and higher prices as downstream as supplies tighten and excessive logistical costs are passed on. Upstream prices will fall as supplies that are unable to be shipped accumulate. Consumers are likely to reset expectations, as items requiring repairs and maintenance are also likely be delayed in lengthy service queues.

If the disruption is severe enough and lasts for a period of time, it is very likely we will observe a major restructuring of the supply chain. A number of participants and service providers are likely to consolidate or leave the industry. Retailers and consumers will find new suppliers, establishing new supply chains supported by more secure logistics. Organizations will look to redesign alternative supply chain flows, inventory storage capabilities closer to their customers, and determine how to best enhance last mile deliveries and returned goods. Industry and governments, alike, are seeking to identify strategies that boost capabilities and build supply chain resilience.

In such challenging time it is likely to be observed that pricing and other marketing elements become less distinguishing factors. Risk management, product quality, and other quality traits are likely to play an increasing role in delivering attributes that can be utilized to generate increased value. In this context, demand generation is likely to evolve as value is redefined as product formulation and design changes in terms of creating “value”. In other words, it is the ability of product formulation and design to generate demand by satisfying customer expectations and requirements.

PRIORITIZING RISK MANAGEMENT

Finally, moving forward it will be increasingly important for an organization to effectively prioritize and manage risks. This includes the need to safeguard procurement and related supply chains as a first line of risk defense.

Atul Vashistha, founder of Supply Wisdom, said; *"When risk management begins in the sourcing stage, threats can be identified and mitigated early on. This will be a top priority to ensure resiliency as the pandemic and other disruptions unfold. As a result, risk management will go beyond just a compliance function... Procurement teams will leverage automation to monitor suppliers for early indicators of threats before they snowball into catastrophes."* [xxviii]

As such, it is imperative that organizations have in place appropriate risk management policies, processes and reporting across their activities.

"A changing business environment should not be feared, but considered an opportunity for a well prepared and managed organization that has the appropriate people, processes and organizational culture firmly in place." – Guy H. Allen

XI. Abbreviations and Glossary

AA – Amino Acids

Name	Single Letter Code	Multiple Letter Code	D-Amino Acid Code
Alanine	A	ALA	{d-ALA}
Arginine	R	ARG	{d-ARG}
Asparagine	N	ASN	{d-ASN}
Aspartic Acid	D	ASP	{d-ASP}
Cysteine	C	CYS	{d-CYS}
Glutamic Acid	E	GLU	{d-GLU}
Glutamine	Q	GLN	{d-GLN}
Glycine	G	GLY	
Homocysteine		HCY	{d-HCY}
Histidine	H	HIS	{d-HIS}
Homoserine		HSE	{d-HSE}
Isoleucine	I	ILE	{d-ILE}
Leucine	L	LEU	{d-LEU}
Lysine	K	LYS	{d-LYS}
Methionine	M	MET	{d-MET}
Norleucine		NLE	{d-NLE}
Norvaline		NVA	{d-NVA}
Ornithine		ORN	{d-ORN}
Penicillamine		PEN	{d-PEN}
Phenylalanine	F	PHE	{d-PHE}
Proline	P	PRO	{d-PRO}
Serine	S	SER	{d-SER}
Threonine	T	THR	{d-THR}
Tryptophan	W	TRP	{d-TRP}
Tyrosine	Y	TYR	{d-TYR}
Valine	V	VAL	{d-VAL}

AAP – Amino Acid Profile (AAP)

AID – Apparent Ileal Digestibility

AMEn – Apparent Metabolisable Energy, N corrected

ANF – Anti-Nutritional Factors

ARG – Argentina

BRA – Brazil

CF – Crude Fibre

CP – Crude Protein

CV – Coefficient of Variation

DE – Digestible Energy

DP – Digestible Protein

DM – Dry Matter

EBITDA – earnings before interest, taxes, depreciation, and amortization

EE – Ether Extract

HDI – Heat Damage Indicators

IPO – Initial Public Offering

KOH – Potassium Hydroxide Protein Solubility

KPIs – Key performance Indicator

MC – Marginal Costs

MP – Metabolizable Protein

MR – Marginal Revenue

N – Nitrogen

NDF – Neutral Detergent Fiber

NE – Net Energy

NFE – Nitrogen-Free Extract

PDI – Protein-Dispersibility Index

SBM – Soybean Meal

SCM – Supply Chain Management

SOR – Segregation of Responsibilities

TI – Trypsin Inhibitors

TIA – Trypsin Inhibitor Activity

TSAA – Total Sulfur Amino Acids

UA – Urease Activity

USA – United States of America

XII. INRAE-CIRAD-AFZ Feed Tables [xxix]

INRAE-CIRAD-AFZ Feed Tables

Source: Feed Tables - https://www.feedtables.com/
Current as of: 12-July-2023 gha
Last Used: 12-July-2023 14:56:23

	Soybean Meal oil 5%-20%	Soybean Meal oil < 5%, 46% protein + oil	Soybean Meal oil < 5%, 48% protein + oil	Soybean Meal oil < 5%, 48% protein + oil, extruded
Description	Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.). This product has a high content in residual oil and results from mechanical pressure only.	Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 46% (as fed) of protein + oil.	Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 48% (as fed) of protein + oil.	Extuded byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 46% (as fed) of protein + oil.

Main Constituents

Parameter	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit
Dry matter	93.2	100 %	-	87.7	100 %	-	88	100 %	-	88	100 %	-
Crude protein	43.8	47 %	-	43.5	49.5 %	-	46.2	52.6 %	-	46.2	52.6 %	-
Crude fibre	6	6.4 %	-	6.3	7.2 %	-	6	6.8 %	-	6	6.8 %	-
Crude fat	8.9	9.5 %	-	1.7	1.9 %	-	1.5	1.8 %	-	1.5	1.8 %	-
Ash	6.1	6.6 %	-	6.5	7.4 %	-	6.2	7.1 %	-	6.2	7.1 %	-
Gross energy (kcal)	4710	5050 kcal/kg	-	4090	4660 kcal/kg	-	4140	4710 kcal/kg	-	4140	4710 kcal/kg	-
Gross energy (MJ)	19.7	21.1 MJ/kg	-	17.1	19.5 MJ/kg	-	17.3	19.7 MJ/kg	-	17.3	19.7 MJ/kg	-

Pigs

Parameter	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit
DE growing pig (kcal)	4020	4320 kcal/kg	-	3460	3940 kcal/kg	-	3520	4000 kcal/kg	-	3520	4000 kcal/kg	-
ME growing pig (kcal)	3730	4000 kcal/kg	-	3170	3620 kcal/kg	-	3220	3660 kcal/kg	-	3220	3660 kcal/kg	-
NE growing pig (kcal)	2450	2630 kcal/kg	-	1970	2240 kcal/kg	-	1980	2250 kcal/kg	-	1980	2250 kcal/kg	-
DE adult pig (kcal)	4250	4560 kcal/kg	-	3680	4200 kcal/kg	-	3740	4250 kcal/kg	-	3740	4250 kcal/kg	-
ME adult pig (kcal)	3910	4190 kcal/kg	-	3350	3820 kcal/kg	-	3390	3850 kcal/kg	-	3390	3850 kcal/kg	-
NE adult pig (kcal)	2600	2790 kcal/kg	-	2110	2410 kcal/kg	-	2120	2410 kcal/kg	-	2120	2410 kcal/kg	-
DE growing pig (MJ)	16.8	18.1 MJ/kg	-	14.5	16.5 MJ/kg	-	14.7	16.8 MJ/kg	-	14.7	16.8 MJ/kg	-
ME growing pig (MJ)	15.6	16.7 MJ/kg	-	13.3	15.1 MJ/kg	-	13.5	15.3 MJ/kg	-	13.5	15.3 MJ/kg	-
NE growing pig (MJ)	10.3	11 MJ/kg	-	8.2	9.4 MJ/kg	-	8.3	9.4 MJ/kg	-	8.3	9.4 MJ/kg	-
DE adult pig (MJ)	17.8	19.1 MJ/kg	-	15.4	17.6 MJ/kg	-	15.7	17.8 MJ/kg	-	15.7	17.8 MJ/kg	-
ME adult pig (MJ)	16.3	17.5 MJ/kg	-	14	16 MJ/kg	-	14.2	16.1 MJ/kg	-	14.2	16.1 MJ/kg	-
NE adult pig (MJ)	10.9	11.7 MJ/kg	-	8.8	10.1 MJ/kg	-	8.9	10.1 MJ/kg	-	8.9	10.1 MJ/kg	-
Energy digestibility growing pig		-	85.4 %		-	84.6 %		-	85 %		-	85 %
Energy digestibility adult pig		-	90.3 %		-	90.1 %		-	90.4 %		-	90.4 %
OM digestibility growing pig		-	86.3 %		-	85.6 %		-	85.9 %		-	85.9 %
OM digestibility adult pig		-	91.5 %		-	91.1 %		-	91.3 %		-	91.3 %
N digestibility growing pig		-	87.3 %		-	86.1 %		-	86.7 %		-	86.7 %
N digestibility adult pig		-	90.4 %		-	89.2 %		-	89.6 %		-	89.6 %
N digestibility ileal standardised pig		-	87.9 %		-	87.1 %		-	87.5 %		-	87.5 %
Crude fat digestibility pig		-	71.8 %		-	30.4 %		-	26 %		-	26 %
Digestible P pig (no phytase)	2.1	2.2 g/kg	32 %	2	2.3 g/kg	32 %	2	2.3 g/kg	32 %	2	2.3 g/kg	32 %
Digestible P pig (with phytase)	3.1	3.3 g/kg	48 %	3	3.4 g/kg	48 %	3	3.4 g/kg	48 %	3	3.4 g/kg	48 %

Poultry

Parameter	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit
AMEn cockerel (kcal)	2840	3050 kcal/kg	-	2260	2580 kcal/kg	-	2300	2610 kcal/kg	-	2300	2610 kcal/kg	-
AMEn broiler (kcal)	2720	2920 kcal/kg	-	2220	2530 kcal/kg	-	2260	2560 kcal/kg	-	2260	2560 kcal/kg	-
AMEn cockerel (MJ)	11.9	12.8 MJ/kg	-	9.5	10.8 MJ/kg	-	9.6	10.9 MJ/kg	-	9.6	10.9 MJ/kg	-
AMEn broiler (MJ)	11.4	12.2 MJ/kg	-	9.3	10.6 MJ/kg	-	9.4	10.7 MJ/kg	-	9.4	10.7 MJ/kg	-
Available P cockerel	1.4	1.5 g/kg	22 % P	1.4	1.6 g/kg	22 % P	1.4	1.6 g/kg	22 % P	1.4	1.6 g/kg	22 % P
Available P broiler	1.4	1.5 g/kg	22 % P	1.4	1.6 g/kg	22 % P	1.4	1.6 g/kg	22 % P	1.4	1.6 g/kg	22 % P

Amino Acids

Parameter	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit
Lysine	27.2	29.2 g/kg	6.2 g/16g N	27	30.8 g/kg	6.2 g/16g N	28.8	32.7 g/kg	6.2 g/16g N	28.8	32.7 g/kg	6.2 g/16g N
Threonine	17.1	18.3 g/kg	3.9 g/16g N	16.8	19.1 g/kg	3.9 g/16g N	17.7	20.1 g/kg	3.8 g/16g N	17.7	20.1 g/kg	3.8 g/16g N
Methionine	6.3	6.7 g/kg	1.4 g/16g N	6.2	7.1 g/kg	1.4 g/16g N	6.6	7.5 g/kg	1.4 g/16g N	6.6	7.5 g/kg	1.4 g/16g N
Cystine	6.7	7.2 g/kg	1.5 g/16g N	6.7	7.7 g/kg	1.5 g/16g N	7.3	8.2 g/kg	1.6 g/16g N	7.3	8.2 g/kg	1.6 g/16g N
Methionine + cystine	13	13.9 g/kg	3 g/16g N	13	14.8 g/kg	3 g/16g N	13.9	15.7 g/kg	3 g/16g N	13.9	15.7 g/kg	3 g/16g N
Tryptophan	5.9	6.3 g/kg	1.3 g/16g N	5.9	6.8 g/kg	1.4 g/16g N	6.4	7.3 g/kg	1.4 g/16g N	6.4	7.3 g/kg	1.4 g/16g N
Isoleucine	20.1	21.6 g/kg	4.6 g/16g N	19.9	22.7 g/kg	4.6 g/16g N	21.1	24 g/kg	4.6 g/16g N	21.1	24 g/kg	4.6 g/16g N
Valine	21.1	22.6 g/kg	4.8 g/16g N	21	23.9 g/kg	4.8 g/16g N	22.3	25.3 g/kg	4.8 g/16g N	22.3	25.3 g/kg	4.8 g/16g N
Leucine	33.3	35.7 g/kg	7.6 g/16g N	33.1	37.7 g/kg	7.6 g/16g N	35.3	40.2 g/kg	7.6 g/16g N	35.3	40.2 g/kg	7.6 g/16g N
Phenylalanine	22.1	23.7 g/kg	5.1 g/16g N	22	25 g/kg	5.1 g/16g N	23.4	26.6 g/kg	5.1 g/16g N	23.4	26.6 g/kg	5.1 g/16g N

Source: "INRAE-CIRAD-AFZ Feed Tables" – Homepage: https://www.feedtables.com/

INRAE-CIRAD-AFZ Feed Tables

Source: Feed Tables - https://www.feedtables.com/
Current as of: 12-July-2023 gha
Last Used: 12-July-2023 14:56:23

	Soybean Meal oil 5%-20%			Soybean Meal oil < 5%, 46% protein + oil			Soybean Meal oil < 5%, 48% protein + oil			Soybean Meal oil < 5%, 48% protein + oil, extruded		
	Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.). This product has a high content in residual oil and results from mechanical pressure only.			Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 46% (as fed) of protein + oil.			Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 48% (as fed) of protein + oil.			Extruded byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 46% (as fed) of protein + oil.		
Tyrosine	15.5	16.6 g/kg	3.5 g/16g N	15.3	17.5 g/kg	3.5 g/16g N	16.3	18.5 g/kg	3.5 g/16g N	16.3	18.5 g/kg	3.5 g/16g N
Phenylalanine + tyrosine	37.6	40.3 g/kg	8.6 g/16g N	37.3	42.5 g/kg	8.6 g/16g N	39.6	45.1 g/kg	8.6 g/16g N	39.6	45.1 g/kg	8.6 g/16g N
Histidine	11.8	12.7 g/kg	2.7 g/16g N	11.7	13.3 g/kg	2.7 g/16g N	12.4	14.1 g/kg	2.7 g/16g N	12.4	14.1 g/kg	2.7 g/16g N
Arginine	32	34.3 g/kg	7.3 g/16g N	31.8	36.2 g/kg	7.3 g/16g N	33.8	38.4 g/kg	7.3 g/16g N	33.8	38.4 g/kg	7.3 g/16g N
Alanine	19.1	20.5 g/kg	4.4 g/16g N	19	21.6 g/kg	4.4 g/16g N	20.1	22.9 g/kg	4.4 g/16g N	20.1	22.9 g/kg	4.4 g/16g N
Aspartic acid	49.1	52.7 g/kg	11.2 g/16g N	48.9	55.7 g/kg	11.3 g/16g N	52.2	59.3 g/kg	11.3 g/16g N	52.2	59.3 g/kg	11.3 g/16g N
Glutamic acid	77.7	83.4 g/kg	17.8 g/16g N	77.4	88.2 g/kg	17.8 g/16g N	82.5	93.8 g/kg	17.8 g/16g N	82.5	93.8 g/kg	17.8 g/16g N
Glycine	18.6	19.9 g/kg	4.2 g/16g N	18.3	20.9 g/kg	4.2 g/16g N	19.4	22 g/kg	4.2 g/16g N	19.4	22 g/kg	4.2 g/16g N
Serine	21.5	23.1 g/kg	4.9 g/16g N	20.9	23.8 g/kg	4.8 g/16g N	21.7	24.7 g/kg	4.7 g/16g N	21.7	24.7 g/kg	4.7 g/16g N
Proline	21.9	23.5 g/kg	5 g/16g N	21.7	24.7 g/kg	5 g/16g N	23	26.1 g/kg	5 g/16g N	23	26.1 g/kg	5 g/16g N
Pigs, Amino Acids												
Parameter	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit
Lysine, ileal standardised, pig	24.5	26.3 g/kg	90 %	24.2	27.6 g/kg	89 %	25.8	29.4 g/kg	90 %	25.8	29.4 g/kg	90 %
Threonine, ileal standardised, pig	14.9	15.9 g/kg	87 %	14.5	16.5 g/kg	86 %	15.3	17.4 g/kg	87 %	15.3	17.4 g/kg	87 %
Methionine, ileal standardised, pig	5.8	6.2 g/kg	92 %	5.7	6.5 g/kg	91 %	6	6.9 g/kg	91 %	6	6.9 g/kg	91 %
Cystine, ileal standardised, pig	5.8	6.2 g/kg	87 %	5.8	6.6 g/kg	86 %	6.3	7.1 g/kg	86 %	6.3	7.1 g/kg	86 %
Methionine + cystine, ileal standardised, p	11.6	12.4 g/kg	89 %	11.5	13.1 g/kg	88 %	12.3	14 g/kg	89 %	12.3	14 g/kg	89 %
Tryptophan, ileal standardised, pig	5.3	5.6 g/kg	89 %	5.3	6 g/kg	89 %	5.7	6.5 g/kg	89 %	5.7	6.5 g/kg	89 %
Isoleucine, ileal standardised, pig	18.1	19.4 g/kg	90 %	17.7	20.2 g/kg	89 %	18.9	21.5 g/kg	89 %	18.9	21.5 g/kg	89 %
Valine, ileal standardised, pig	18.7	20 g/kg	88 %	18.4	21 g/kg	88 %	19.7	22.4 g/kg	88 %	19.7	22.4 g/kg	88 %
Leucine, ileal standardised, pig	29.8	32 g/kg	90 %	29.5	33.6 g/kg	89 %	31.5	35.8 g/kg	89 %	31.5	35.8 g/kg	89 %
Phenylalanine, ileal standardised, pig	20.1	21.6 g/kg	91 %	19.8	22.6 g/kg	90 %	21.2	24 g/kg	90 %	21.2	24 g/kg	90 %
Tyrosine, ileal standardised, pig	14.2	15.2 g/kg	92 %	14	15.9 g/kg	91 %	14.9	16.9 g/kg	91 %	14.9	16.9 g/kg	91 %
Phenylananine + tyrosine, ileal standardis	34.3	36.8 g/kg	91 %	33.8	38.5 g/kg	91 %	36	40.9 g/kg	91 %	36	40.9 g/kg	91 %
Histidine, ileal standardised, pig	10.7	11.5 g/kg	91 %	10.5	12 g/kg	90 %	11.2	12.7 g/kg	91 %	11.2	12.7 g/kg	91 %
Arginine, ileal standardised, pig	30.1	32.3 g/kg	94 %	29.8	33.9 g/kg	94 %	31.8	36.1 g/kg	94 %	31.8	36.1 g/kg	94 %
Alanine, ileal standardised, pig	16.5	17.7 g/kg	86 %	16.2	18.4 g/kg	85 %	17.3	19.6 g/kg	86 %	17.3	19.6 g/kg	86 %
Aspartic acid, ileal standardised, pig	44.1	47.3 g/kg	90 %	43.6	49.7 g/kg	89 %	46.7	53.1 g/kg	89 %	46.7	53.1 g/kg	89 %
Glutamic acid, ileal standardised, pig	70.2	75.3 g/kg	90 %	69.2	78.8 g/kg	89 %	74.2	84.3 g/kg	90 %	74.2	84.3 g/kg	90 %
Glycine, ileal standardised, pig	15.8	17 g/kg	85 %	15.3	17.5 g/kg	84 %	16.4	18.6 g/kg	84 %	16.4	18.6 g/kg	84 %
Serine, ileal standardised, pig	19.2	20.6 g/kg	89 %	18.5	21.1 g/kg	89 %	19.3	22 g/kg	89 %	19.3	22 g/kg	89 %
Proline, ileal standardised, pig	18.5	19.8 g/kg	84 %	19.4	22.1 g/kg	90 %	20.6	23.5 g/kg	90 %	20.6	23.5 g/kg	90 %
Poultry, Amino Acids												
Parameter	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit	As fed	On DM Unit	Other Unit
Lysine, ileal standardized, poultry	24	25.7 g/kg	88 %	23.8	27.1 g/kg	88 %	25.3	28.8 g/kg	88 %	25.3	28.8 g/kg	88 %
Threonine, ileal standardized, poultry	14.2	15.2 g/kg	83 %	13.9	15.9 g/kg	83 %	14.7	16.7 g/kg	83 %	14.7	16.7 g/kg	83 %
Methionine, ileal standardized, poultry	5.7	6.1 g/kg	90 %	5.6	6.4 g/kg	90 %	5.9	6.8 g/kg	90 %	5.9	6.8 g/kg	90 %
Cystine, ileal standardized, poultry	5	5.4 g/kg	75 %	5	5.8 g/kg	75 %	5.4	6.2 g/kg	75 %	5.4	6.2 g/kg	75 %
Methionine + cystine, ileal standardized, p	10.7	11.5 g/kg	82 %	10.6	12.1 g/kg	82 %	11.4	12.9 g/kg	82 %	11.4	12.9 g/kg	82 %
Tryptophan, ileal standardized, poultry	5.2	5.6 g/kg	89 %	5.3	6 g/kg	89 %	5.7	6.5 g/kg	89 %	5.7	6.5 g/kg	89 %
Isoleucine, ileal standardized, poultry	17.5	18.8 g/kg	87 %	17.3	19.8 g/kg	87 %	18.4	20.9 g/kg	87 %	18.4	20.9 g/kg	87 %
Valine, ileal standardized, poultry	18.1	19.5 g/kg	86 %	18	20.5 g/kg	86 %	19.2	21.8 g/kg	86 %	19.2	21.8 g/kg	86 %
Leucine, ileal standardized, poultry	28.9	31.1 g/kg	87 %	28.8	32.8 g/kg	87 %	30.7	34.9 g/kg	87 %	30.7	34.9 g/kg	87 %
Phenylalanine, ileal standardized, poultry	19.2	20.6 g/kg	87 %	19.1	21.8 g/kg	87 %	20.3	23.1 g/kg	87 %	20.3	23.1 g/kg	87 %
Tyrosine, ileal standardized, poultry	13.6	14.6 g/kg	88 %	13.5	15.4 g/kg	88 %	14.3	16.3 g/kg	88 %	14.3	16.3 g/kg	88 %
Phenylalanine + tyrosine, ileal standardiz	32.8	35.2 g/kg	87 %	32.6	37.1 g/kg	87 %	34.7	39.4 g/kg	87 %	34.7	39.4 g/kg	87 %
Histidine, ileal standardized, poultry	10.3	11 g/kg	87 %	10.2	11.6 g/kg	87 %	10.8	12.2 g/kg	87 %	10.8	12.2 g/kg	87 %
Arginine, ileal standardized, poultry	28.8	30.9 g/kg	90 %	28.6	32.6 g/kg	90 %	30.4	34.6 g/kg	90 %	30.4	34.6 g/kg	90 %
Alanine, ileal standardized, poultry	16.5	17.7 g/kg	86 %	16.3	18.6 g/kg	86 %	17.3	19.7 g/kg	86 %	17.3	19.7 g/kg	86 %
Aspartic acid, ileal standardized, poultry	41.3	44.3 g/kg	84 %	41.1	46.8 g/kg	84 %	43.8	49.8 g/kg	84 %	43.8	49.8 g/kg	84 %
Glutamic acid, ileal standardized, poultry	69.2	74.2 g/kg	89 %	68.9	78.5 g/kg	89 %	73.5	83.5 g/kg	89 %	73.5	83.5 g/kg	89 %
Glycine, ileal standardized, poultry	15.6	16.7 g/kg	84 %	15.4	17.6 g/kg	84 %	16.3	18.5 g/kg	84 %	16.3	18.5 g/kg	84 %
Serine, ileal standardized, poultry	18.5	19.8 g/kg	86 %	18	20.5 g/kg	86 %	18.7	21.2 g/kg	86 %	18.7	21.2 g/kg	86 %
Proline, ileal standardized, poultry	18.8	20.2 g/kg	86 %	18.6	21.2 g/kg	86 %	19.8	22.5 g/kg	86 %	19.8	22.5 g/kg	86 %

Source: "INRAE-CIRAD-AFZ Feed Tables" – Homepage: https://www.feedtables.com/

INRAE-CIRAD-AFZ Feed

Source:
Current as of:
Last Used:

Soybean Meal oil < 5%, 48% protein + oil, formaldehyde-treated
Formaldehyde-treated byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It has been treated with formaldehyde to reduce the degradability of protein in the rumen, resulting in a higher availability of protein in the intestine. It should contain about 48% (as fed) of protein + oil.

Soybean Meal oil < 5%, 50% protein + oil
Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), without reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 50% (as fed) of protein + oil.

Soybean, Whole, Extruded (Glycine max (L.) Merr.). Other Name: **Extruded Full-Fat Soybean**
Extruded soybean seed (Glycine max (L.) Merr.).
Other name: extruded full-fat soybean.

Soybean, Whole, Toasted (Glycine max (L.) Merr.). Other Name: **Toasted Full-Fat Soybean**
Toasted (dry heated) soybean seed (Glycine max (L.) Merr.).
Other name: toasted full-fat soybean

	Soybean Meal, oil < 5%, 48% protein + oil, formaldehyde-treated					Soybean Meal, oil < 5%, 50% protein + oil					Soybean, Whole, Extruded					Soybean, Whole, Toasted				
Main Constituents																				
Parameter	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit
Dry matter	88	100	%	-		88	100	%	-		89.5	100	%	-		88.5	100	%	-	
Crude protein	46.2	52.6	%	-		48.5	55.2	%	-		36	40.2	%	-		35.8	40.4	%	-	
Crude fibre	6	6.8	%	-		3.9	4.4	%	-		5.6	6.3	%	-		5.8	6.5	%	-	
Crude fat	1.5	1.8	%	-		1.5	1.7	%	-		18.4	20.5	%	-		19.7	22.3	%	-	
Ash	6.2	7.1	%	-		6.4	7.3	%	-		5.1	5.7	%	-		4.9	5.5	%	-	
Gross energy (kcal)	4140	4710	kcal/kg	-		4150	4710	kcal/kg	-		4980	5560	kcal/kg	-		5020	5670	kcal/kg	-	
Gross energy (MJ)	17.3	19.7	MJ/kg	-		17.4	19.7	MJ/kg	-		20.8	23.3	MJ/kg	-		21	23.7	MJ/kg	-	
Pigs																				
Parameter	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit
DE growing pig (kcal)	0	0	kcal/kg	-		3630	4130	kcal/kg	-		3810	4250	kcal/kg	-		3820	4310	kcal/kg	-	
ME growing pig (kcal)	0	0	kcal/kg	-		3310	3770	kcal/kg	-		3570	3990	kcal/kg	-		3590	4050	kcal/kg	-	
NE growing pig (kcal)	0	0	kcal/kg	-		2060	2340	kcal/kg	-		2620	2930	kcal/kg	-		2660	3010	kcal/kg	-	
DE adult pig (kcal)	0	0	kcal/kg	-		3820	4340	kcal/kg	-		4160	4650	kcal/kg	-		4180	4720	kcal/kg	-	
ME adult pig (kcal)	0	0	kcal/kg	-		3460	3930	kcal/kg	-		3890	4340	kcal/kg	-		3910	4420	kcal/kg	-	
NE adult pig (kcal)	0	0	kcal/kg	-		2180	2470	kcal/kg	-		2820	3150	kcal/kg	-		2860	3230	kcal/kg	-	
DE growing pig (MJ)	0	0	MJ/kg	-		15.2	17.3	MJ/kg	-		15.9	17.8	MJ/kg	-		16	18	MJ/kg	-	
ME growing pig (MJ)	0	0	MJ/kg	-		13.9	15.8	MJ/kg	-		15	16.7	MJ/kg	-		15	17	MJ/kg	-	
NE growing pig (MJ)	0	0	MJ/kg	-		8.6	9.8	MJ/kg	-		11	12.3	MJ/kg	-		11.1	12.6	MJ/kg	-	
DE adult pig (MJ)	0	0	MJ/kg	-		16	18.2	MJ/kg	-		17.4	19.5	MJ/kg	-		17.5	19.8	MJ/kg	-	
ME adult pig (MJ)	0	0	MJ/kg	-		14.5	16.5	MJ/kg	-		16.3	18.2	MJ/kg	-		16.4	18.5	MJ/kg	-	
NE adult pig (MJ)	0	0	MJ/kg	-		9.1	10.4	MJ/kg	-		11.8	13.2	MJ/kg	-		12	13.5	MJ/kg	-	
Energy digestibility growing pig		-		0	%		-		87.5	%		-		76.4	%		-		76	%
Energy digestibility adult pig		-		0	%		-		92	%		-		83.6	%		-		83.2	%
OM digestibility growing pig		-		0	%		-		88.1	%		-		77.8	%		-		77.3	%
OM digestibility adult pig		-		0	%		-		92.6	%		-		86.2	%		-		86	%
N digestibility growing pig		-		0	%		-		90.1	%		-		85.2	%		-		85	%
N digestibility adult pig		-		0	%		-		92.4	%		-		91.2	%		-		91.1	%
N digestibility ileal standardised pig		-		0	%		-		89.8	%		-		83	%		-		74	%
Crude fat digestibility pig		-		0	%		-		28.8	%		-		80	%		-		80	%
Digestible P pig (no phytase)	0	0	g/kg	0	%	2	2.3	g/kg	32	%	1.8	2	g/kg	32	%	1.7	1.9	g/kg	32	%
Digestible P pig (with phytase)	0	0	g/kg	0	%	3	3.4	g/kg	48	%	2.7	3	g/kg	48	%	2.5	2.8	g/kg	48	%
Poultry																				
Parameter	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit
AMEn cockerel (kcal)	0	0	kcal/kg	-		2390	2720	kcal/kg	-		3310	3700	kcal/kg	-		3200	3620	kcal/kg	-	
AMEn broiler (kcal)	0	0	kcal/kg	-		2350	2670	kcal/kg	-		3530	3940	kcal/kg	-		3410	3860	kcal/kg	-	
AMEn cockerel (MJ)	0	0	MJ/kg	-		10	11.4	MJ/kg	-		3210	3580	kcal/kg	-		3090	3490	kcal/kg	-	
AMEn broiler (MJ)	0	0	MJ/kg	-		9.8	11.2	MJ/kg	-		3420	3830	kcal/kg	-		3300	3730	kcal/kg	-	
Available P cockerel	0	0	g/kg	0	% P	1.4	1.6	g/kg	22	% P	13.9	15.5	MJ/kg	-		13.4	15.1	MJ/kg	-	
Available P broiler	0	0	g/kg	0	% P	1.4	1.6	g/kg	22	% P	13.4	15	MJ/kg	-		12.9	14.6	MJ/kg	-	
											1.4	1.6	g/kg	25	% P	1.3	1.5	g/kg	25	% P
Amino Acids																				
Parameter	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit	As fed	On DM	Unit	Other	Unit
Lysine	28.8	32.7	g/kg	6.2	g/16g N	30.2	34.3	g/kg	6.2	g/16g N	22.4	25	g/kg	6.2	g/16g N	22.2	25.1	g/kg	6.2	g/16g N
Threonine	17.7	20.1	g/kg	3.8	g/16g N	18.4	20.9	g/kg	3.8	g/16g N	14.6	16.3	g/kg	4	g/16g N	14.4	16.3	g/kg	4	g/16g N
Methionine	6.6	7.5	g/kg	1.4	g/16g N	6.9	7.9	g/kg	1.4	g/16g N	5.2	5.8	g/kg	1.4	g/16g N	5.2	5.8	g/kg	1.4	g/16g N
Cystine	7.3	8.2	g/kg	1.6	g/16g N	7.7	8.7	g/kg	1.6	g/16g N	5.3	5.9	g/kg	1.5	g/16g N	5.3	6	g/kg	1.5	g/16g N
Methionine + cystine	13.9	15.7	g/kg	3	g/16g N	14.6	16.6	g/kg	3	g/16g N	10.5	11.8	g/kg	2.9	g/16g N	10.5	11.8	g/kg	2.9	g/16g N
Tryptophan	6.4	7.3	g/kg	1.4	g/16g N	6.8	7.7	g/kg	1.4	g/16g N	4.6	5.1	g/kg	1.3	g/16g N	4.6	5.2	g/kg	1.3	g/16g N
Isoleucine	21.1	24	g/kg	4.6	g/16g N	22.1	25.1	g/kg	4.6	g/16g N	16.8	18.7	g/kg	4.7	g/16g N	16.6	18.8	g/kg	4.7	g/16g N
Valine	22.3	25.3	g/kg	4.8	g/16g N	23.4	26.6	g/kg	4.8	g/16g N	17.3	19.4	g/kg	4.8	g/16g N	17.2	19.5	g/kg	4.8	g/16g N
Leucine	35.3	40.2	g/kg	7.6	g/16g N	37.2	42.2	g/kg	7.7	g/16g N	27.2	30.3	g/kg	7.5	g/16g N	27	30.5	g/kg	7.5	g/16g N
Phenylalanine	23.4	26.6	g/kg	5.1	g/16g N	24.5	27.9	g/kg	5.1	g/16g N	18.2	20.3	g/kg	5.1	g/16g N	18.1	20.4	g/kg	5.1	g/16g N

Source: "INRAE-CIRAD-AFZ Feed Tables" – Homepage: https://www.feedtables.com/

INRAE-CIRAD-AFZ Feed

Source:

Current as of:

Last Used:

	Soybean Meal oil < 5%, 48% protein + oil, formaldehyde-treated Formaldehyde-treated byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), with partial reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It has been treated with formaldehyde to reduce the degradability of protein in the rumen, resulting in a higher availability of protein in the intestine. It should contain about 48% (as fed) of protein + oil.			**Soybean Meal** oil < 5%, 50% protein + oil Byproduct of oil manufacture obtained by extraction of soybean seeds (Glycine max (L.) Merr.), without reintroduction of the hulls. This product has a low content in residual oil and results from mechanical pressure followed by solvent extraction. It should contain about 50% (as fed) of protein + oil.			**Soybean, Whole, Extruded** (Glycine max (L.) Merr.). Other Name: **Extruded Full-Fat Soybean** Extruded soybean seed (Glycine max (L.) Merr.). Other name: extruded full-fat soybean.			**Soybean, Whole, Toasted** (Glycine max (L.) Merr.). Other Name: **Toasted Full-Fat Soybean** Toasted (dry heated) soybean seed (Glycine max (L.) Merr.). Other name: toasted full-fat soybean		
Tyrosine	16.3	18.5 g/kg	3.5 g/16g N	17.1	19.4 g/kg	3.5 g/16g N	12.8	14.3 g/kg	3.6 g/16g N	12.7	14.3 g/kg	3.6 g/16g N
Phenylalanine + tyrosine	39.6	45.1 g/kg	8.6 g/16g N	41.6	47.3 g/kg	8.6 g/16g N	31	34.6 g/kg	8.6 g/16g N	30.8	34.8 g/kg	8.6 g/16g N
Histidine	12.4	14.1 g/kg	2.7 g/16g N	12.9	14.7 g/kg	2.7 g/16g N	9.8	11 g/kg	2.7 g/16g N	9.8	11 g/kg	2.7 g/16g N
Arginine	33.8	38.4 g/kg	7.3 g/16g N	35.5	40.3 g/kg	7.3 g/16g N	26.3	29.4 g/kg	7.3 g/16g N	26.1	29.5 g/kg	7.3 g/16g N
Alanine	20.1	22.9 g/kg	4.4 g/16g N	21.1	24 g/kg	4.3 g/16g N	15.3	17.1 g/kg	4.3 g/16g N	15.2	17.2 g/kg	4.3 g/16g N
Aspartic acid	52.2	59.3 g/kg	11.3 g/16g N	54.9	62.4 g/kg	11.3 g/16g N	40.1	44.8 g/kg	11.1 g/16g N	39.8	45 g/kg	11.1 g/16g N
Glutamic acid	82.5	93.8 g/kg	17.8 g/16g N	86.8	98.7 g/kg	17.9 g/16g N	63.4	70.8 g/kg	17.6 g/16g N	63	71.1 g/kg	17.6 g/16g N
Glycine	19.4	22 g/kg	4.2 g/16g N	20.3	23.1 g/kg	4.2 g/16g N	15.5	17.3 g/kg	4.3 g/16g N	15.4	17.4 g/kg	4.3 g/16g N
Serine	21.7	24.7 g/kg	4.7 g/16g N	22.3	25.4 g/kg	4.6 g/16g N	18.9	21.2 g/kg	5.3 g/16g N	18.8	21.2 g/kg	5.2 g/16g N
Proline	23	26.1 g/kg	5 g/16g N	24.1	27.4 g/kg	5 g/16g N	18.1	20.2 g/kg	5 g/16g N	18	20.3 g/kg	5 g/16g N
Pigs, Amino Acids												
Parameter	**As fed**	**On DM Unit**	**Other Unit**	**As fed**	**On DM Unit**	**Other Unit**	**As fed**	**On DM Unit**	**Other Unit**	**As fed**	**On DM Unit**	**Other Unit**
Lysine, ileal standardised, pig	0	0 g/kg	0 %	27.7	31.5 g/kg	92 %	19.5	21.8 g/kg	87 %	17.5	19.7 g/kg	79 %
Threonine, ileal standardised, pig	0	0 g/kg	0 %	16.3	18.5 g/kg	89 %	12.2	13.6 g/kg	84 %	10.9	12.3 g/kg	75 %
Methionine, ileal standardised, pig	0	0 g/kg	0 %	6.4	7.3 g/kg	92 %	4.4	5 g/kg	85 %	4	4.5 g/kg	78 %
Cystine, ileal standardised, pig	0	0 g/kg	0 %	6.8	7.8 g/kg	89 %	4.2	4.7 g/kg	80 %	4	4.5 g/kg	75 %
Methionine + cystine, ileal standardised, p	0	0 g/kg	0 %	13.2	15 g/kg	91 %	8.7	9.7 g/kg	83 %	8	9 g/kg	76 %
Tryptophan, ileal standardised, pig	0	0 g/kg	0 %	6.2	7.1 g/kg	91 %	3.5	4 g/kg	77 %	3.8	4.3 g/kg	83 %
Isoleucine, ileal standardised, pig	0	0 g/kg	0 %	20.2	22.9 g/kg	91 %	14.2	15.9 g/kg	85 %	12.3	13.9 g/kg	74 %
Valine, ileal standardised, pig	0	0 g/kg	0 %	21.1	24 g/kg	90 %	14.6	16.3 g/kg	84 %	12.7	14.3 g/kg	74 %
Leucine, ileal standardised, pig	0	0 g/kg	0 %	33.8	38.5 g/kg	91 %	23	25.8 g/kg	85 %	20.4	23.1 g/kg	76 %
Phenylalanine, ileal standardised, pig	0	0 g/kg	0 %	22.7	25.8 g/kg	92 %	15.7	17.5 g/kg	86 %	13.9	15.7 g/kg	77 %
Tyrosine, ileal standardised, pig	0	0 g/kg	0 %	15.8	18 g/kg	93 %	11.2	12.5 g/kg	88 %	9.9	11.2 g/kg	78 %
Phenylananine + tyrosine, ileal standardis	0	0 g/kg	0 %	38.5	43.8 g/kg	93 %	26.9	30.1 g/kg	87 %	23.9	26.9 g/kg	77 %
Histidine, ileal standardised, pig	0	0 g/kg	0 %	11.9	13.6 g/kg	92 %	8.6	9.7 g/kg	88 %	7.9	8.9 g/kg	81 %
Arginine, ileal standardised, pig	0	0 g/kg	0 %	33.8	38.4 g/kg	95 %	23.9	26.7 g/kg	91 %	21.6	24.5 g/kg	83 %
Alanine, ileal standardised, pig	0	0 g/kg	0 %	18.6	21.2 g/kg	88 %	12.8	14.3 g/kg	83 %	11.2	12.7 g/kg	74 %
Aspartic acid, ileal standardised, pig	0	0 g/kg	0 %	50.1	56.9 g/kg	91 %	34.9	39.1 g/kg	87 %	31	35.1 g/kg	78 %
Glutamic acid, ileal standardised, pig	0	0 g/kg	0 %	80.5	91.5 g/kg	93 %	55.8	62.3 g/kg	88 %	49.3	55.7 g/kg	78 %
Glycine, ileal standardised, pig	0	0 g/kg	0 %	18.1	20.6 g/kg	89 %	12.8	14.3 g/kg	82 %	11.4	12.8 g/kg	74 %
Serine, ileal standardised, pig	0	0 g/kg	0 %	20.4	23.1 g/kg	91 %	16.2	18.1 g/kg	85 %	14.6	16.5 g/kg	78 %
Proline, ileal standardised, pig	0	0 g/kg	0 %	22.1	25.1 g/kg	92 %	15.9	17.7 g/kg	88 %	13.1	14.8 g/kg	73 %
Poultry, Amino Acids												
Parameter	**As fed**	**On DM Unit**	**Other Unit**	**As fed**	**On DM Unit**	**Other Unit**	**As fed**	**On DM Unit**	**Other Unit**	**As fed**	**On DM Unit**	**Other Unit**
Lysine, ileal standardized, poultry	0	0 g/kg	0 %	26.6	30.2 g/kg	88 %	19	21.3 g/kg	85 %	18.9	21.3 g/kg	85 %
Threonine, ileal standardized, poultry	0	0 g/kg	0 %	15.3	17.3 g/kg	83 %	11.2	12.5 g/kg	77 %	11.1	12.6 g/kg	77 %
Methionine, ileal standardized, poultry	0	0 g/kg	0 %	6.2	7.1 g/kg	90 %	4.4	4.9 g/kg	84 %	4.3	4.9 g/kg	84 %
Cystine, ileal standardized, poultry	0	0 g/kg	0 %	5.8	6.5 g/kg	75 %	3.6	4 g/kg	68 %	3.6	4.1 g/kg	68 %
Methionine + cystine, ileal standardized, p	0	0 g/kg	0 %	12	13.6 g/kg	82 %	8	8.9 g/kg	76 %	7.9	9 g/kg	76 %
Tryptophan, ileal standardized, poultry	0	0 g/kg	0 %	6.1	6.9 g/kg	89 %	3.4	3.8 g/kg	75 %	3.4	3.9 g/kg	75 %
Isoleucine, ileal standardized, poultry	0	0 g/kg	0 %	19.2	21.9 g/kg	87 %	13.9	15.5 g/kg	83 %	13.8	15.6 g/kg	83 %
Valine, ileal standardized, poultry	0	0 g/kg	0 %	20.1	22.9 g/kg	86 %	14.2	15.9 g/kg	82 %	14.1	16 g/kg	82 %
Leucine, ileal standardized, poultry	0	0 g/kg	0 %	32.3	36.8 g/kg	87 %	22.5	25.2 g/kg	83 %	22.4	25.3 g/kg	83 %
Phenylalanine, ileal standardized, poultry	0	0 g/kg	0 %	21.3	24.3 g/kg	87 %	15.3	17.1 g/kg	84 %	15.2	17.2 g/kg	84 %
Tyrosine, ileal standardized, poultry	0	0 g/kg	0 %	15	17.1 g/kg	88 %	10.4	11.6 g/kg	81 %	10.3	11.6 g/kg	81 %
Phenylalanine + tyrosine, ileal standardiz	0	0 g/kg	0 %	36.3	41.3 g/kg	87 %	25.6	28.7 g/kg	83 %	25.5	28.8 g/kg	83 %
Histidine, ileal standardized, poultry	0	0 g/kg	0 %	11.3	12.8 g/kg	87 %	8.2	9.2 g/kg	84 %	8.2	9.3 g/kg	84 %
Arginine, ileal standardized, poultry	0	0 g/kg	0 %	31.9	36.3 g/kg	90 %	22.9	25.6 g/kg	87 %	22.7	25.7 g/kg	87 %
Alanine, ileal standardized, poultry	0	0 g/kg	0 %	18.1	20.6 g/kg	86 %	12.4	13.9 g/kg	81 %	12.3	13.9 g/kg	81 %
Aspartic acid, ileal standardized, poultry	0	0 g/kg	0 %	46.1	52.4 g/kg	84 %	32.5	36.3 g/kg	81 %	32.3	36.4 g/kg	81 %
Glutamic acid, ileal standardized, poultry	0	0 g/kg	0 %	77.3	87.8 g/kg	89 %	53.2	59.5 g/kg	84 %	52.9	59.8 g/kg	84 %
Glycine, ileal standardized, poultry	0	0 g/kg	0 %	17	19.4 g/kg	84 %	11.9	13.3 g/kg	77 %	11.9	13.4 g/kg	77 %
Serine, ileal standardized, poultry	0	0 g/kg	0 %	19.2	21.8 g/kg	86 %	15.3	17.1 g/kg	81 %	15.2	17.2 g/kg	81 %
Proline, ileal standardized, poultry	0	0 g/kg	0 %	20.7	23.6 g/kg	86 %	15	16.8 g/kg	83 %	14.9	16.8 g/kg	83 %

Source: "INRAE-CIRAD-AFZ Feed Tables" – Homepage: https://www.feedtables.com/

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