

Strategic management of technology at Frito-Lay's Kern manufacturing facility

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Keywords

Quality.
Automated guided vehicles.
Strategic management

Abstract

Recognizing that technology is an important element of competitive strategy, the Frito-Lay Kern facility has invested substantially in both its people and technology. Reviews the technology and process applications, highlights organizational approaches and discusses implementation issues and success factors at the Kern facility.

Introduction

The Frito-Lay Kern plant is a 375,000 sq.ft processing and warehouse facility, which sits on 640 acres, or one square mile, of property in Kern County, California, USA. This site has the ability to operate independently of any city or county infrastructure by providing its own electrical power, compressed air, domestic water, and waste water treatment systems. The site produces 6.2mW of electrical energy via a co-generation operation. The co-generation plant also produces steam for the heating of water and oil in the manufacturing process. Two domestic wells supply the plant with 1.2 million gallons of water a day, and maintain emergency water storage for fire protection. The facility also provides a wastewater treatment facility, which is in turn applied to a 325-acre alfalfa farming operation. With recent plant expansions, the manufacturing processes have the ability to produce on ten different product lines, achieving over 525SKUs. Total plant output yields over 127,000,000 pounds per year, or 2,442,307 pounds per week, equating to 2,000,000 bags per day. From a warehouse and logistics standpoint, the handling of 97,692 cases a day requires 16 truck docks for both shipping and receiving. Today, the Kern plant ranks among the top performing plants in the USA and employs over 750 people. To manufacture at this level, the Frito-Lay Kern facility has invested substantially in both its people and technology.

This paper reviews the technology and process applications and discusses the recent expansions to the Kern facility and how technology was introduced to provide a transparent transformation.

State-of-the-art technologies

Initial construction began in 1986 with a 175,000 sq.ft facility, and five production lines: one Lay's[®] potato chip line, two Frito[®] lines, and two Doritos[®] lines. The warehouse is composed of an automated storage and retrieval system (AS/RS), manufactured by HK Systems, with four storage retrieval vehicles (SRVs) and 20 automated guided vehicles (AGVs), with a capacity of approximately 4,000 pallet bays. The AS/RS system operates under a "first-in/ first-out" philosophy and turns over products in approximately 2.3 days. In 1995, the plant was expanded by an additional 140,000 sq.ft with the addition of three more SRVs, 12AGVs, one Baked Potato Chip[®] line, one Baked Tostitos[®] line, and one Rolled Gold[®] pretzel line. In 1996, an additional pretzel line was installed just prior to another 60,000 sq.ft expansion incorporating a Reduced Oil Tortilla Chip line (ROTC), Reduced Fat Doritos[®]. In 1997, the ROTC line was modified to produce one of Frito-Lay's new products, WOW[®], made with Olean[®], a synthetic oil manufactured by Proctor & Gamble (Ohama, 2000).

State-of-the-art bakery

Kern's 1995 bakery expansion added an additional 140,000 sq.ft of facility utilized for processing, packaging and warehouse storage. The processing and packaging lines operated independently of the existing infrastructure and computer technology systems. The technology incorporated into the Bakery was similar in design and technology as the existing core plant, but incorporated new state of the art computer integrated management (CIM) systems coupled with a faster broadband communication network known as the Data Highway (DH).

The CIM system "... uses computers and communications networks to transform automated manufacturing systems into



interconnected systems ..." which allows coordination and collaboration between computers and the functions they formulate. (Attaran, 1996). The DH network links Allen Bradley 504 (500 series) programmable logic controllers (PLC) and operator interface terminals (OIT) which serve as the "backbone" of the computing and interfacing needs required in an automated factory. The OIT allows line operators to communicate to the CIM system in a pre-defined format, allowing line manipulation, in the form of production throughput, quality, raw ingredients, moisture content, and temperature settings. The OIT uses a graphical interface program (GIP), known as Wonderware[®], to provide a visual representation of all equipment speeds and settings. Additionally, this program provides real time data to the operator to access line performance. Settings established by the operators must conform to a pre-established matrix of variables to allow the CIM systems to maintain an "auto" mode of operations. Production line permissive matrixes vary depending on the product type, seasons, and mode of operation. Operational modes vary, and are dependent upon the function being performed. For example, the "start-up" mode allows the manufacturing line to achieve specified set points before any product is processed through the system. This function eliminates the waste of raw ingredients and the labor associated to it in the form of transportation, receiving, and staging. As the predefined set points are established, the CIM system will display real time information of all conditions throughout the line. The operator can then select the auto mode for line production. As the line ramps up in production volume, the CIM system will continuously monitor all the line variables (in the form of inputs, both discrete and analog, and display those variables to the OIT).

The CIM system will further monitor the line inputs and via output modules, will control line temperatures and speeds. The computer programming matrixes, sometimes in the form of cascaded programming loops, looks at statistical process control (SPC) programs to evaluate trends and will make line compensations to provide a steady state process. If computer input signals deviate outside, above or below, predefined set points, the CIM system will provide both audio and visual alarms to notify the operator of a control point deviation. The operator will then have to assess the situation to determine a proper course of action. Figure 1 illustrates the bakery CIM network in a generic format.

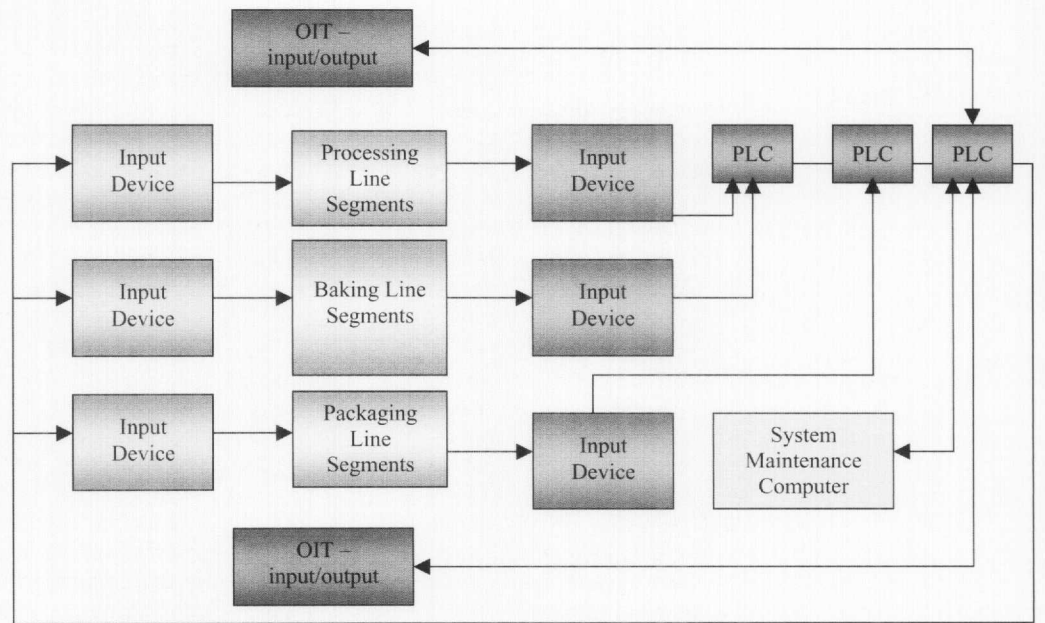
The automated warehouse

The warehouse system comprises six different computer systems, each responsible for specific warehouse functions. First, a system known as Auto motion[®] transfers core products to an induction lanes system. The Auto motion[®] system receives cased product from the potato chip, Fritos, and Doritos lines. This system is composed of a number of conveyance systems, which utilize a number of photo sensors to traffic the flow of products to the induction system. Two induction lanes separate cases so that a bar code scanner can determine the type of product being conveyed. Next, the system transfers individual cases on to a tilt tray conveyance system that delivers the cases to one of 30 lanes, predetermined for a specific product type. Both the induction lane and tilt tray systems operate off the same computer. Once the product has been delivered to one of the 30 lanes, five automated case palletizers, manufactured by Fanuc, will automatically palletize the cases in predetermined formats. Fanuc robot palletizers are similar in construction to those robots found in automated car assembly lines – primarily in the welding applications. The implementation of the robots eliminated five positions, but created higher skilled positions. Once the palletizers have completed a full pallet, the pallet is staged for AGV pickup. The palletizing phase of the project focused on streamlining of the core products business.

The AS/RS system also had to accommodate the new bakery expansion. Upper management evaluated the cost and infrastructure requirements to determine the feasibility of expanding the automation process. At that time, management determined the feasibility to be outside the strategic needs of the business. However, management did determine the need with respect to utilizing the AS/RS system in the bakery. Approximately 600yd of additional underground wiring (subsurface) were needed for AGV tracking and monitoring. New AGV induction points were installed adjacent to bakery packaging where manual palletizing and transfer systems were incorporated. Underground wiring had to be incorporated on predetermined shutdowns to allow for system startup and program initialization.

Regardless of pallet input stations from the bakery induction points and the input points of the auto palletizers, the system would transfer all products to the AS/RS input stations, known as pickup and drop off (P&D) stands. At this point, the SRVs would continuously deliver products to and from

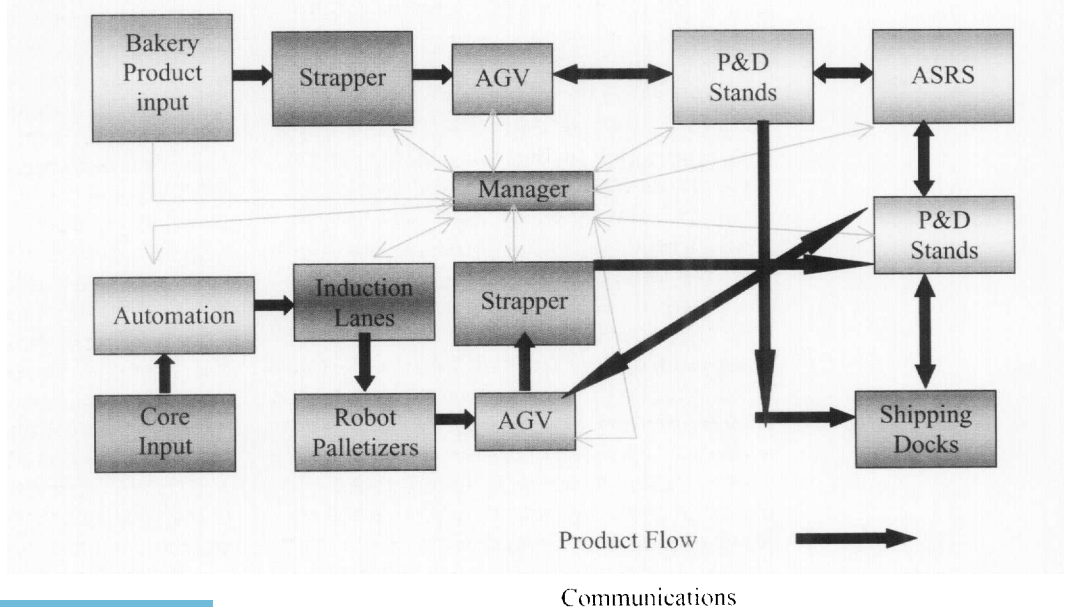
Figure 1
 Generic CIM layout



the P&D stands for insertion into the 6,000-pallet location high rise. Pallets being pulled from the high rise were normally delivered to shipping docks for transportation to predetermined drop-off points (distribution centers, direct deliveries to retailers, and promotional staging areas). The entire automated warehouse system is managed by a computer system, which coordinates all computer systems, known as "The Manager". Figure 2 illustrates the new automated warehouse computer system. A centrally

located control room houses all the computers where operational modes can be changed to meet the changing demands of the logistical networks. The operational modes work within an auto mode function providing flexibility to the dynamics of the system. Modes consist of a balance mode, input mode, and an output mode. The balanced mode is the normal mode of operations, which equally distributes the AGVs in inputting and removing product from the AS/RS system. The output mode

Figure 2
 Warehouse systems



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will shift system priorities, providing a 60 percent focus on the removal of products from the AS/RS system. This mode is invoked when the high rises in reaching near full capacity.

Packaging room management with auto case packer and erectors

The packaging room management (PRM), derived as a corporate initiative, was a four-year pilot project that re-engineered the PC packaging lines. Initially, two auto case erectors (ACE) were installed to speed up line efficiencies by 30 percent. As a step function, the auto case packers (ACP) followed suit, thus eliminating the need for a packer. Line efficiencies again increase by an additional 10 percent. The incorporation of this technology proved challenging at the time. Employee frustrations rose not in the loss of jobs, but more so in the loss of control. Top management held team meetings with the PC teams to discuss the upcoming technology and the implications involved. Management's foresight proved pivotal in the future of this project. Management affirmed employee reassignments were to be absorbed by natural attrition without layoffs.

After the project was installed, the loss of control was more evident in the lack of performance of the new automated equipment. In weekly meetings, employees and line managers discussed the obstacles they faced with the new technology and, with upper management's support, an engineering team was redirected to combat operational concerns.

As the technology proved to be successful, the PRM system was incorporated. This system would serve as an information tool to provide management real time information on machine efficiency, over/under weight statistics, packer efficiency, packaging machine operator (PMO) efficiency, and inventory management. The PC packaging room consisted of 18 lines, eight of which were automated with ACE and ACP. The combination of the ACEs, ACPs, and PRM turned the PC packaging department into the most efficient process in all of Frito-Lay.

Prior to the beginning of this project, packaging labor efficiencies hovered around 77 percent. With the implementation of this new technology, the packaging department was sky rocketed to 104 percent sustained labor efficiency. (Note: headquarters in terms of cases packed per hour establishes labor efficiencies. This standard is based on a human performing the packing of the cases.

Reduced Oil Tortilla Chip expansion

The Reduced Oil Tortilla Chip (ROTC) expansion occurred in 1996 with a 60,000 sq.ft addition to the northwest side of the plant. This expansion was very complex in nature and required a great deal more of coordination between the plant, contractors, and headquarters. Operations management proved to be an integral part of the decision-making processes thus providing the necessary resources to implement such a project.

Resource allocations came in the form of two project engineers, operators, quality assurance, sanitation, maintenance and processing managers. As construction was underway, a production manager, line operators, quality assurance, and maintenance technicians traveled to the R&D facility for formal training. The training encompassed all facets of the project, from equipment functions, start up sequences, computer programming, ladder logic sequences, operational parameters, and trouble-shooting techniques. Once training was complete, the operators returned to the facility and trained the remaining personnel. Subsequently, new positions had to be filled to staff the new line thus trained personnel had to backfill, requiring the training of new personnel.

The ROTC line was to be positioned adjacent to the existing Doritos lines, thus increasing the complexity of the project. Numerous pieces of equipment had to be installed without any disruption to production lines. To make this happen, a pseudo-construction wall had to be built to separate construction activities from production. Once the building was erected, new equipment had to be installed. Additionally, new infrastructure had to be routed through the existing facility, and steam, water, and electrical ties had to be coordinated with operations. The new electrical infrastructure required additional motor starters and variable frequency drives (VFD) to be tied into an Allen Bradley PLC5-80 processor. VFDs control motor speeds on belts, conveyors, fans, and pumps to match line throughput requirements. The new CIM system functioned on the same network as the existing processing lines. Additionally, an adaptive process controller (APC) would be incorporated into the CIM system to control product-finished oils. The OIT system utilized a Windows NT program - similar to other parts of the plant. On successful installation, a three-week engineering test run had to be performed. As in all new line start-ups, a systematic approach to debugging the new system had to

be conducted. In this phase of the project, data communications are vigorously tested to determine all networking issues. Since the computer systems were similar to existing equipment, few problems were encountered over the network. The majority of issues stemmed from minor ladder logic programming changes to end device calibration, tuning, and wire landings on terminal blocks. One important factor in a successful transition between engineering and operations hand over, is the involvement of line operators during the engineering test run phase. This provides operators with a "hands on approach" to become acclimatized with the controls and sequencing line parameters. Additionally, operators are encouraged to note any issues or concerns, which are to be addressed by engineering. Once the engineering test runs were complete, a two-week line commissioning was initiated. The line commissioning required a team effort from engineering, maintenance, operations, logistics, sanitation, and quality assurance. The objective was to fine-tune the line to produce the highest quality product. On a daily basis, engineering would conduct a meeting discussing the day's progress, issues that arose, issues needing attention, resources required for the next day's run, and the objective for the next day.

WOW! expansion

Shortly after the ROTC expansion, a new product made with Olean[®] oil was to be installed modifying the ROTC line. The building addition was minor, and the equipment modification required the removal of some major pieces of equipment, being replaced with new upgraded equipment. Programming changes made allocations for line flexibility in producing either WOW! or Doritos products. This required new programming permissive matrixes to operate the line in different configurations. The existing CIM system was utilized with additional PLCs and input/output racks. The major issue with the WOW! project was the Olean[®] oil. On the existing lines, the oil maintains a liquid state at room temperature, whereas the Olean[®] oil would congeal. The implementation of this project is minimal as to the direction of this paper; however, to better understand the scope of the project, see the Appendix.

Automated control

A number of the processing lines incorporate what is known as a MM-55 (recent upgrade to MM-56), which monitors product oils and moisture contents. The oil and moisture

characteristics directly affect product texture, taste, and shelf life. The MM-55 interfaces with the CIM system providing an analog signal as to the product oil and moisture levels. The computer will, via ladder logic programs, send signals to the fryer (in this scenario) to compensate for deviations in standard set points. The computer program will send signals to control fryer temperature and dwell times.

Obstacles

Even with all the planning that can be done in advance of implementation, the state-of-the-art technology utilized in the Kern plant must be adaptable to changes in the business. Furthermore, contingency plans were very important. How would certain operations run if the systems crashed? Would the entire plant be shut down by a computer? While some of these issues were addressed before start up, others developed which had not been anticipated.

Training and investment

CIM technology requires a substantial amount of training expense and capital investment. Computer programmers, maintenance technicians, operators, and managers have to have a high degree of training and confidence to operate and troubleshoot such a system. Staffing changes were made to ensure that the plant had qualified technicians who could troubleshoot problems that developed and interface with the programmers when changes were required. Likewise, traditional models of cost justification do not consider the hidden cost of quality, and justification may have to rely on head count reduction and increased throughput capacity.

Modification of existing programs and technologies

The second phase of the bakery expansion incorporated the addition of three SRVs (totaling seven), commonly known as cranes. In addition to the SRVs, there were 12 AGVs totaling 32. This phase of the project yielded many obstacles to the implementation of not only new equipment to an existing process, but the modification of existing programs and technologies. To further compound this project, the project engineers in conjunction with operations, warehouse and logistics personal had to formulate a tactical plan of action to make the transition as transparent as possible. Being a food manufacturing facility, this team had to keep line

interruptions to a minimum thus allowing daily operations to continue as normal, and at the same time maintain Frito-Lay's high level of food safety, known as good manufacturing practices (GMP). The GMP program is an industry standard, which establishes food safety protocols required by the American Institute of Baking (AIB).

Systems interruptions

CIM system interruptions in computers or communication networks have proved challenging at times. For example, during poor weather, lighting storms have been known to spike the electrical distributions system. "Spikes" of this nature have actually shut down parts of the CIM system. In this case "The Manager". As the warehouse system goes down, and usually takes one hour to three hours to reinitiate, production usually shuts down two or more production lines, thus losing the ability to meet service to sales. As product cases stack up on the warehouse floor, the remaining lines have to reduce throughput, further compounding the problem. Furthermore, inventory tracking is minimized or lost, thus causing swings in over/under production rates. As with any line startup or shutdown, raw materials are lost in the process, and labor becomes inefficient. No data was available as to the cost of such a CIM interruption, but based on experience, the figure could easily mount to tens of thousands of dollars.

Growth

As small scope projects come about, the existing CIM infrastructure needs to have the capacity to grow and adopt new technologies and applications. For example, on the Doritos lines, operations requested an engineering analysis to determine the feasibility to better control oil level within the fryers. In this case, an oil level deviation of two inches could change the fryer dwell time, thus affecting chip moisture. A Hydpark sonic sensor (communicating with a 4-20mA signal) working in conjunction with a Maxon metering valve (receiving a signal from the computer) would modulate the flow of oil into the fryer, thus maintaining a level with a deviation less than half of an inch.

Benefits derived

CIM technology has allowed many companies to compete on a global basis; however, there are advantages and disadvantages to incorporating such technology. The Frito-Lay Kern facility is highly dependent on its CIM system. This technology has not only

increased quality, but has actually maintained consistently high quality at increased throughput rates. Because of the precision made possible by the automated system, material waste also has been minimized. Other benefits of CIM technology that were realized are flexibility, improved service, faster response times, and higher inventory turnover rates.

Another advantage CIM technology bestowed on the Kern facility is the increase in line throughput. By increasing line capacities, future capital investment is deferred from new expensive plant construction and startups. Not only has the Kern plant seen increased throughputs, economies of scale, but also the plant has the ability to make a number of different products at the same time, thus providing economies of scope. Efficiency is achieved through variety rather than repetitiveness. For example, the potato chip line has the ability to produce regular Lays[®] Potato Chips while producing two variations of flavored chips. This is not limited to just Lay's[®] Potato Chips, as the same line can produce Ruffles and Wavy brand chips. In the plant as large as Bakersfield, the ability to shift quickly from one mix to another, or to change from one flavor to another greatly improves efficiency and productivity.

Implementation issues/success factors

CIM requires a new perspective on the part of management – maybe even a new philosophy. Top management, manufacturing and industrial engineers must change their way of thinking and develop new skills. CIM success requires deliberate and careful planning of technical elements in conjunction with training from day one. To take full advantage of CIM's benefits, the entire manufacturing process from product design to procurement, production scheduling, management, production and delivery must be integrated. The existing infrastructure of the organization must be altered to facilitate cooperation between engineering, marketing, manufacturing, accounting and information services departments. Moreover, traditional financial techniques must be redirected to quantify and track productivity improvements generated from flexibility, improved efficiency, and higher productivity (Attaran, 1997).

The technology in itself does not guarantee success in increased efficiencies and reduced inventory turnover times. Management plays

a fundamental role in the indoctrination of such initiatives. Management's foresight in communicating new projects and the potential impacts to the Kern employees was critical to the overall success. Management has clearly adopted a new management style that incorporates flexibility, customer service, employee welfare, quality, and training. In 1994, Frito-Lay implemented a corporate initiative which changed the company's management philosophy of top-down style management to continuous improvement (CI) process.

The employees play an equally important role in the success of CIM. Management needs to understand that CIM implementation will not simply affect the blue-collar worker. It will reach deep into the white-collar world as well. Employee fears about job displacement need to be alleviated or at least explained. To prepare workers for their new roles, management needs to begin an education and training program before CIM arrival. Workers need to be educated about the future impact of CIM technology. They need to know what roles the machines will assume and what roles will be opened up for employees. Whether through shop seminars, in-house classes or study towards an advanced degree, employees need to have the opportunity to retrain themselves to complete effectively those new tasks that are required by CIM technology (Attaran, 1997). Employee ownership is another fundamental in the implementation and sustaining of CIM technology. In the Frito-Lay's Kern manufacturing facility employees are provided with all the resources necessary to perform their respective tasks and make decisions that were once taken by managers. This decision-making process has greatly increased the success of such projects and has illustrated a greater level of ownership. Project implementation teams carry a cross-functional diversity of people throughout the Kern organization. Team members usually consist of the plant manager, technical manager, quality manager, unit leaders, scheduling manager, sanitation manager, capital project resource, warehouse unit leader, team leaders, processing technicians, packaging technicians, quality technicians, maintenance technicians and facilities manager. Frito-Lay headquarters also assembles a cross-functional team consisting of a project manager, project engineer, sales, marketing, equipment designers, vendors, suppliers, contractors, commissioning coordinator, food scientists,

electrical engineers, controls engineers, information technologist, processing engineers, packaging engineers, and field quality personnel. The commitment instilled by Frito-Lay executives is substantial. Resource allocations and capital investments provide the necessary tools for successful implementation of new technologies.

Quality initiatives are best illustrated by what is known as a quality "wall". The "wall" is a real time product evaluation conducted once every four hours that brings together operators, quality assurance technicians, the quality manager, plant manager, production manager and line operators. Wide ranges of product attributes are evaluated to assess a "weak-link" score. The "weak-link" score rates the product as green, yellow, or red, where the lowest score determines the quality of the product. Quality logs are actively used to document issues and action plans, which are followed up at the next product "wall".

Innovative products are best illustrated by those in the Appendix. Frito-Lay continuously evaluates new products and test markets to determine geographical acceptance. For example, some products are produced in geographical areas where a demand may be greater than what would be seen on a national market. In some cases, the new product may display some forms of "cannibalization": where the new product will take consumers from the existing product lines.

Conclusions

Frito-Lay's Kern manufacturing facility is one of the most efficient salt snack food manufacturing facilities in both the USA and internationally. The CIM systems incorporated have unlocked the vast potential in manufacturing efficiencies. Time and time again, Frito-Lay's corporate headquarters has determined the Kern facility to be a key manufacturing facility. Pilot projects are typically installed, to determine feasibility in relaying a strategic and competitive advantage.

The Frito-Lay Kern facility has overcome all barriers to successfully implementing CIM technologies. The success illustrated by the Kern facility should serve as a model for not only other Frito-Lay facilities, but also the industry as a whole. This model is not to be considered as a rigid structure, but one which is flexible, evolving and adaptive. As Charles Darwin said, "It is not the strongest, or the most intelligent that survives, but the most adaptive to change".

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Appendix. Frito-Lay time line

- 1932 - the Frito Company was founded in San Antonio by Elmer Doolin.
- 1933 - Frito Company moves to Dallas, Texas.
- 1938 - Herman W. Lay founded H.W. Lay & Company, in Atlanta.
- 1942 - Lays begins production on a continuous potato chip machine.
- 1944 - Lay Company is one of the first snack companies to advertise on TV.
- 1945 - Frito Company grants H.W. Lay & Company exclusive franchise to manufacture and distribute Fritos[®] brand corn chips in south-east.
- 1948 - Cheetos[®] brand cheese flavored snack introduced nationally skyrocket in popularity in first month.
- 1955 - Frito-Lay[®] brand bean dip introduced.
- 1958 - Frito Company sales grow to \$51 million and acquires trademark rights to Ruffles[®].
- 1959 - President Nixon takes Fritos[®] to Nikita Krushchev in Russia.
- 1961 - The Frito Company and H.W. Lay & Company merged to form Frito-Lay, Inc. with headquarters in Texas.
- 1961 H.W. Lay and Company acquires facilities for national distribution of Rold Gold[®] pretzels.
- 1962 - Fritos sold in over 48 countries.
- 1965 - PepsiCo, Inc. is founded by Donald M. Kendall, president and chief executive officer of Pepsi-Cola, and Herman W. Lay, chairman and chief executive officer of Frito-Lay, through the merger of the two companies.
- 1965 - Lays[®] brand potato chip first to go nationally.
- 1966 - Doritos[®] brand tortilla chips introduced nationally means "little bits of gold" in Spanish.
- 1967 - taco flavored Doritos big hit for customers.
- 1969 - Funyons[®] brand onion rings introduced.
- 1971 - Munchos[®] brand potato chips introduced.
- 1972 - national distribution of nacho cheese flavored Doritos[®].
- 1973 - gas shortage shuts down some production facilities.
- 1973 - Foods International, later called PepsiCo Foods International (PFI) and subsequently named Frito-Lay International, is established to market snack foods around the world.
- 1980 - Frito-Lay Cheetos[®] ruffed balls introduced.
- 1981 - Tostitos[®] brand tortilla chips introduced.
- 1983 - Grandma's[®] cookies distributed nationally.
- 1984 - Dips Jalapeno flavored Cheddar and mild cheddar cheese introduced.
- 1984 - PepsiCo is restructured to focus on its three core businesses: soft drinks, snack foods and restaurants. Transportation and sporting goods businesses are sold.
- 1985 - Santitas[®] introduced.
- 1985 - PepsiCo is now the largest company in the beverage industry. The company has revenues of more than \$7.5 billion, more than 137,000 employees. Pepsi-Cola products are available in nearly 150 countries and territories around the world. Snack food operations are in ten international markets.
- 1986 - The corporation is reorganized and decentralized. Beverage operations are combined under PepsiCo Worldwide Beverages; snack food operations are combined under PepsiCo Worldwide Foods.
- 1986 - Ruffles[®] sour cream, French onion, and Fritos Mild & Wild introduced.
- 1986 - Chester Cheetah becomes spokesman.
- 1989 - Frito-Lay restructures into four divisions giving more responsiveness to customers. Frito-Lay acquires Smart Food[®] brand popcorn, Ruffles Mesquite Grille BBQ flavor, ranch flavored potato chips, Cheetos curls introduced.
- 1990 - PepsiCo enters top 25 of *Fortune* 500 ranking. With sales of \$15.4 billion, it is number 23. The company has more than 300,000 employees.
- 1990 - Frito-Lay introduces Cheddar Crackers[®] snacks, low fat Ruffles, Sun Chips introduced in test market.
- 1991 - Frito-Lay creates 22 sales / marketing offices bringing decision making closer to retail customer.
- 1991 - Lays[®] Tangy Ranch, Flamin Hot, Cheetos[®] Paws, Flamin Hot, Tostitos[®] Restaurant style, Lime & Chili introduced.
- 1991 - Sales of \$100 million national retail.
- 1992 - Lays[®] potato chips reformulated.

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- 1993 – Wavy Lays and Tostitos unsalted introduced.
- 1993 – Both PepsiCo beverages and snack food operating profits pass the \$1 billion mark.
- 1994 KC Master Piece, Baked Lays[®], Doritos[®] Cooler Ranch, Ruffles[®] Reduced Fat, Fritos[®] Scoops, and Rold Gold[®] Thins introduced.
- 1995 – PepsiCo sales reach \$30.4 billion. There are 470,000 employees worldwide, making PepsiCo the third largest employer.
- 1995 – Mesquite BBQ, Baked Tostitos[®], Fritos[®] Texas Grille, Tostitos[®] Bite Size introduced.
- 1995 – Olean[®] approved by FDA – WOW! chips introduced in test market.
- 1996 – Pepsi-Cola domestic and international operations combined into

Pepsi-Cola Company. International and domestic snack food operations combined into one business unit called the Frito-Lay Company.

- 1997 – PepsiCo is a \$29 billion company with approximately 140,000 employees worldwide.
- 1997 – Frito-Lay purchases Cracker Jacks from Borden.
- 1997 – Lays[®] Pizza flavor, Lipton[®] French Onion, Lays[®] Red Pepper Grille introduced.
- 1998 – WOW![®] products launched.

Source: Frito-Lay Investor Information Historical Background (1999), available at: <http://www.fritolay.com/investor/factoids/history.html>