RETHINKING PRODUCTION SYSTEMS IN AMERICA FOR THE 21ST CENTURY

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INTRODUCTION

Automotive startup, Smith Electric Vehicles (SEV) of Kansas City, Missouri, was challenged with how to produce, assemble, and deliver their battery powered truck to the emerging U.S. electric vehicle market. The overarching but unspoken question was: "Should they follow conventional automotive thinking and build a large, highly automated, centralized mass production facility or, was there a better way?" This article is about the breakthrough thinking behind Smith Electric Vehicle's 21st century distributed production system model they consider the center of their competitive advantage and a key factor in driving marketplace adoption of their vehicle.

Bringing a new product to the marketplace is challenging for even the most experienced organizations in a good economy. For a startup organization setting out to commercialize a new product in the worst economic recession in 70 years it is more than just a challenge. It is a task that requires innovative thinking combined with sound execution and leadership. Brian Hansel, SEV CEO, and his team faced this task as they approached the U.S. market launch of the "Newton" electric delivery vehicle.

Commercializing a new product begins with an idea and ends with a product in the hands of the customer. It also involves sustaining the marketplace's interest in that idea and product. To accomplish this there are many details to be managed and problems to be solved. Successful marketplace acceptance is achieved by remaining true to three foundational principles:

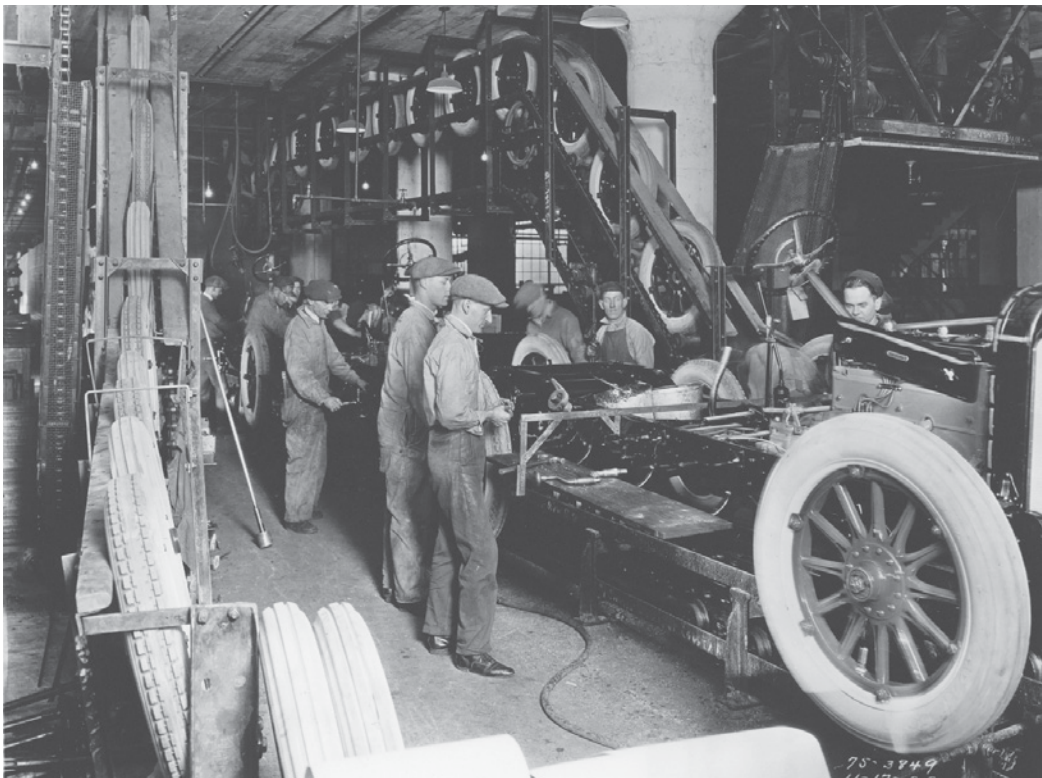
1. Discover the total customer context.
2. Design products whose value proposition is aligned to this context.
3. Develop a sustainable production system that delivers the value proposition and is also aligned to the total customer context.

All of the above principles are equally important and cannot be done in isolation. SEV had to embrace each of them in order to solve their production system design issues.

A CENTURY OF PRODUCT COMMERCIALIZATION

The beginning of the 20th century saw the introduction of many products and technologies. One of these was the automobile. At this time, the automobile was produced using 19th century techniques of traditional horse-drawn carriage assembly. It was sold to elite customers who could afford this new novelty.

Henry Ford was one of the early producers. However, Ford had a vision for this product with a different customer context. Ford's idea was that everyone earning a decent salary could own one of these automobiles.



How was this vision and new understanding of the customer context achieved? He invented a production system centered on the assembly line. This system centralized the factors of production and organized manufacturing into a sequential chain of work elements when set into motion would produce products at a specified rate. The assembly line enabled Ford to both standardize and accelerate the manufacture of his product, the Model-T. With the assembly line Ford was able to "mass produce" automobiles making them available to consumers at an affordable price.

Throughout the 20th century engineers and practitioners have studied, tested, developed, and refined the foundational tools that make the mass production processes of today repeatable and predictable. However, one of the key requirements of mass production is to have a mass homogenized market. Therefore, in parallel to this was the development of mass marketing and advertising to create and drive demand for the products. Together these mass concepts changed the face of the way we produce and deliver products today.

GLOBALIZATION

In the last third of the 20th century, domestic industry faced competition from global mass producers utilizing the same principles, but at a lower cost structure. The impact to successful commercialization in the United States has been significant. Specifically, by the saturation of brands, the customer and market context has become segmented (even fragmented) and less predictive. As a result, the value proposition of products became more complex compared to the vertically manufactured, mass marketed, mass advertised, and brand developed commercial strategies previously successful in our American economy.

Globalization caused mass production methodology to rapidly become more complex. The immediate reaction was to relocate domestic factories and supplier sourcing to leverage lower cost options. This led to farflung manufacturing operations and supply chains. The trend in turn gave rise to globalized logistics and centralized mass warehousing. This has contributed to more complexity in all aspects of production. The unintended consequences of this complexity, such as longer lead-time, component quality issues, transportation issues, product integrity problems, and communication difficulties, instead resulted in a total higher cost and greater operating risk.

CHANGING CUSTOMER CONTEXT

The impact of globalization coupled with the recent economic downturn has contributed to a changing social consciousness across the spectrum of economic, environmental, and community issues from which the fabric of American society is woven.

Communities traditionally dependent upon manufacturing as a base have become economically unstable. One of the leading reasons for this is manufacturing jobs have been dispersed across the globe leaving these communities without economically sustainable jobs. The high-tech and "knowledge worker" jobs many thought would replace these losses have also become victims of the same off-shore sourcing strategies. The employment opportunities filling the vacuum do not have the same value added impact. The negative consequences of this came to the forefront of public attention with the advent of the severe recession of 2008/2009 and are altering the behaviors of customers and consumers in many markets. Specifically, they are becoming more socially conscious in the selection of products and services.

THE SMITH ELECTRIC VEHICLE BUSINESS CASE

SEV'S TOTAL CUSTOMER CONTEXT

The Newton is a light to medium duty electric delivery truck with an operating range of one hundred (100) miles and a top speed of fifty (50) MPH. Smith's potential customers are located in an urban environments where routes average about forty-five (45) miles. These customers want to comply with local state and federal emissions guidelines. They want to reduce their fuel costs and carbon footprint. They want to reduce their maintenance costs. Many of their urban consumers have expectations for their communities of both environmental and economic sustainability.

These urban areas are building light-rail systems, buying electric-hybrid transit buses, giving tax incentives for LEED certification, have strong "buy local" movements, and want to keep jobs in their community. They have a tendency to buy more from companies perceived to be aligned to this context.

VALUE PROPOSITION OF THE NEWTON

The SEV all electric vehicles help their customers to comply with local, state, and federal emissions guidelines. It will lower fuel costs and reduce their carbon footprint. Over the life of the vehicle it has less maintenance costs than current internal combustion trucks. The electric truck also aligns customer's corporate responsibility with the environmental social consciousness in the communities they serve.

For Smith, the solution of how-to produce and deliver their battery powered trucks seemed to be obvious. Simply follow the automotive production system model and build an automotive production facility that could produce enough trucks to meet their forecasted demand, apply the correct levels of automation to achieve efficiency, and marketing would take care of the remainder of the equation. After all, this is the way automotive vehicles have been produced for nearly a hundred years.

All Smith needed to do was to determine the size and location of the facility, the production process, how to manage their global supply chain with the facility and, finally, how to deliver the finished truck from the facility to their customers throughout the United States.

To determine the location, size and scope of their automotive produc-

tion facility, Smith considered the forecasted demand for their vehicles. Their business plan called for ramping up annual sales and production from one-hundred (100) vehicles a year to twelve thousand five-hundred (12,500) vehicles a year and they wanted to complete this ramp-up within three (3) years.

From a transportation and delivery perspective Smith needed to put their production facility in a location central to their customer base. With potential customers in cities on both the East and West coasts as well as in the Midwest, this meant a location somewhere near the center of the continent. From a sales forecast point-of-view, Smith would ultimately need a facility capable of producing sixty (60) vehicles per day. Their goal of operating on one (1) production shift meant a long assembly line. They needed enough warehousing space to store the parts needed to support a supply chain with a lead-time of up to six (6) months. Furthermore, the site needed room to accommodate finished trucks waiting to be loaded onto rail cars for delivery around the country.

All of this a proven model, but something was not adding up. Smith was not producing a truck for a homogenized mass market. Instead, they were producing a truck for customers in very specific market contexts geographically dispersed throughout the U.S. Analyses (i.e. financial, production modeling, transportation and delivery, marketing, risk assessment) revealed many shortcomings with the centralized mass production system plan.

BREAKTHROUGH THINKING

Although the SEV truck met most of the value proposition criteria, this did not give their "all electric" truck a market differentiator. First, emerging technologies such as diesel hybrids and hydraulic assist hybrids were being developed by established mass manufacturing companies. Second, these products had the potential to enter the market at a lower price point.

Smith's primary asset was having a market-ready product (initially developed in England) for a market segment no current competitor had yet addressed with a "green" vehicle. Going head-to-head with existing automotive companies already possessing the enormous infrastructure of large factories, distribution centers, and dealer networks would not give Smith a competitive advantage. These production systems have a high cost and long lead-time for new product introduction to the marketplace. Investment of the capital and time required to create a similar approach from scratch is not viable in today's economy. SEV needed something different: a production system that gave them both speed to market and market acceptance before any of the traditional 20th century companies could fill the demand. The answer was found in a hybrid model of a distributed production system we term the "Sustainable Production System." The Sustainable Production System (SPS) has several characteristics that separate this model from traditional production system thinking and qualify this solution as "groundbreaking" in its approach.

THE PRINCIPLES OF SPS ARE:

Localized assembly, sales, service, delivery, and customer education. SPS is focused on the communities that support the growing social consciousness in urban cities weighted in sustainability thinking and action. It locates appropriately sized production facilities into those communities where the product is used. These facilities utilize simple, flexible technologies scaled to the local demand. They also serve as sales and service centers, solving the problem of establishing a dealer network required by centralized assembly. They are focused on a 100-mile radius where customers can pick up their trucks and drive them away. The facilities provide customer education and interface with the local community. The writers use the term Geographic Integration Center (GIC). The GIC is its own profit center. They also serve as a local innovation center and provide direct input of the voice of their local customers.

Centralized leadership and support functions. The SPS leverages Internet communication technology and capabilities to allow centralized key functions of leadership, design, engineering, and research into one location operating as the brain of the networked production system. We use the term Global Leadership Center (GLC). It coordinates the geographically distributed centers. It also is integrated with a GIC serving the local vicinity while acting as a test bed to standardize new product designs and manufacturing concepts for the other distributed centers.

Repurposing abandoned sites, no Greenfield. Using abandoned car dealerships, big box stores, and other buildings is both environmentally friendly and revitalizing to urban areas.

Integrating a local, regional, and global supply chain as appropriate. The integration of a localized supply chain is developed in those communities where the production facilities are located. This concept creates additional jobs and supports the sustainability of the communities where the product is being sold and used. Regional U.S. supply chain development is applied where local supply chain sourcing is not feasible. Globalizing portions of the supply chain is only applied in limited cases.

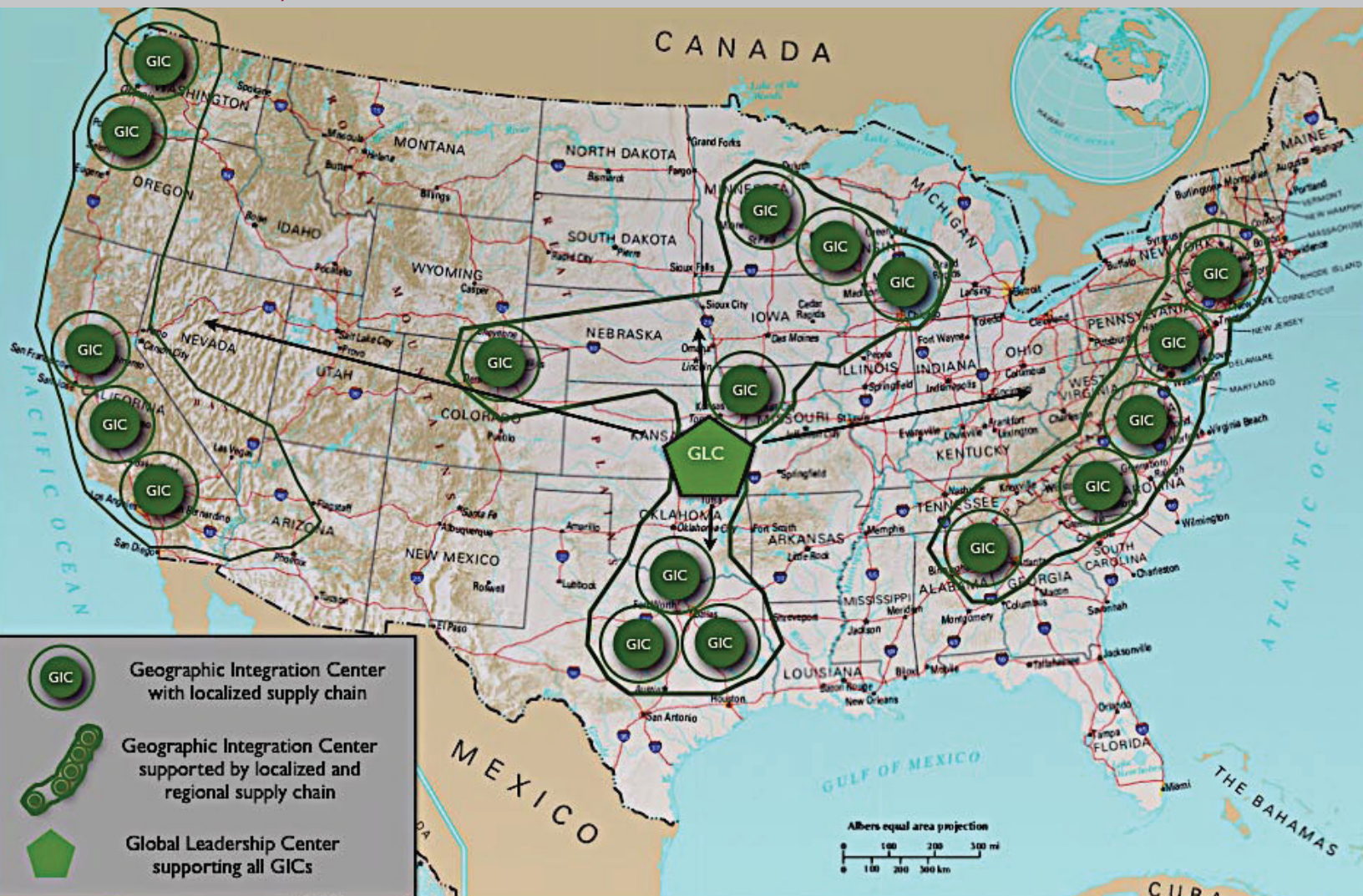
Leveraging federal, state, and local government resources. One of the tenets of SPS is building local economies while becoming responsible members of the community. It helps build the foundation of a sustainable community. This is a process repeated in each large urban area when a GIC is established. The strategy for the SPS is leveraging state and local resources for incentives, grants, and business partnerships with local governments and corporations. Conversely, centralized facilities can only gain support from one state or local government.

Utilizing 21st century Internet communications technology. Fortunately, we live today in a world where technology is ever progressing. The Internet makes virtual face-to-face communication possible and information is instantly available. If this technology is leveraged in the correct manner, various roles that are traditionally duplicated between facilities can be eliminated. Leadership can be right sized and centrally located. Production can be monitored remotely. Production problems can be viewed remotely. Problem resolution can be jointly addressed between centralized engineering and local plant personnel.

WHERE SEV IS NOW

SEV has adopted the Sustainable Production System as an overall strategy. They are moving forward with plans to establish the Global Leadership Center (GLC) in Kansas City, Mo. They are structuring and standard-

Sustainable Production System



izing their production processes for deployment in the Geographic Integration Centers (GIC). SEV has also utilized the SPS strategy to obtain an additional 22 million in government grants and additional funding in private financing to launch the production of vehicles. SEV has said they also plan an Initial Public Offering (IPO) of common stock sometime in the first half of 2011.

According to the Kansas City Business Journal, Smith Electric has announced plans to build as many as 20 regional assembly plants nationwide, which company officials say will speed up sales and assist marketing by giving customers in each market a local place to buy and service vehicles. "We really do feel that the opportunity for this technology to really get broad adoption is if you localize it," said CEO Bryan Hansel in another KC Business Journal article. "We view the distributed model as the center of our competitive advantage and the key to market adoption." says Hansel. "This plant is doing more than building new vehicles. You're building the economy," President Obama said during a recent visit to SEV. "There is a thriving enterprise here instead of the ghostly silence of an empty building."

VALIDATION OF THE SUSTAINABLE PRODUCTION SYSTEM

Another Urban Product: The Smart Car

The Smart car was designed to be tuned to the urban environment where parking is limited. The car represents the latest refinement of 20th century mass production. All components are modular and assembled in a capital intensive, advanced technology plant in southern France designed around principles of Lean manufacturing. Currently cars are shipped to more than 39 different countries from the centralized plant.

Production in Europe began in 1997, but to date the car has never been profitable and the plant has yet to reach its full capacity of 180,000 units per year. From 2003 to 2006, Smart lost nearly four billion Euros (€).

The Smart ForTwo was introduced in the United States in 2008 where the car is sold through an extensive network of more than 78 dealers, most exclusive to Smart cars, and many not located in city centers. The marketing is aimed at young urban professionals embracing social consciousness of environmental sustainability. The Smart U.S. Web site devotes an entire page to touting the "eco-friendly" design of the Hambach "Smartville" assembly facility. But somehow the car has failed to reverberate with its target customers. After the initial introduction, sales have steadily declined despite the addition of new models. According to The Wall Street Journal (10/07/2010 article by N. Boudette), monthly purchases have fallen to an average per dealership of six (6) vehicles. Penske Automotive, the owner of the Smart dealer network in the United States, acknowledged in the same article the current level of sales is not profitable. Penske is engaged with Nissan Motor Co. to begin marketing an alternative line of small cars under the Smart logo produced from plants in Mexico.

With its modular design, could Smart have benefited from a strategy similar to the Sustainable Production System? The car misses the mark on aligning itself to local economic sustainability. It is considered a European curiosity by most Americans, including the urban dwellers it courts. They have no "buy local" sentiments to make them want a Smart car over competing small vehicles from other mass producers. In addition, the dealer network did not tap into the assistance from state and local governments offered to businesses bringing jobs to their communities.

Coca-Cola

In 1984, The Coca-Cola Company made a strategic decision to change its process for bottling and distributing soft drinks. The new vision called for abandoning the company's near century old localized bottling system for a centralized system. Coca-Cola strategically located mega-bottling plants and distribution centers near concentrations of large customers like Wal-Mart, Kroger, Safeway, Publix, and Target.

The new centralized system was viewed as a more easily managed

and cost effective model. However, unforeseen consequences included:

- Inability to service all customers (could only economically deliver to large customers)
- Loss of market share
- Higher transportation costs
- Operational complexities (facilities, workforce, supply chain, customer)
- Loss of community visibility
- Loss of business and operating flexibility
- Loss of the voice of the customer and consumer
- Quality issues
- Labor issues
- Escalating operating costs

In 2010, Coca-Cola announced that the company was abandoning the centralized model.

SUMMARY/CONCLUSIONS:

The Smith Electric Vehicles SPS is 180 degrees away from the mass production model. The SPS is based on a self-sustaining business model. Each GIC location is an appropriately scaled profit-center. The physical facility is located in the community where the customer is located. The system is vertically grown in the community as the supply base decisions are made by location, quality, and service. The focus, while sensitive to cost, is not completely built on cost reduction as a model it is built on a total cost control model. The focus is on self-sustaining communities. Jobs, product flexibility, service, sales, ownership, and pride in what is produced and consumed are the benefits of the system. Each GIC is based on a true pull demand from the customer. Trucks are not produced until an order is placed. This SPS is aligned to the emerging American social consciousness of the 21st century.

At the same time this production system leverages the best features of the 20th century centralized models such as; integrated research and development, manufacturing engineering, and executive leadership by leveraging Internet communication technologies unavailable during the development of mass manufacturing.

Sustainable production systems (SPS) are key to the re-industrialization of American manufacturing. Successful development of a SPS begins by remaining true to three foundational principles:

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