## TOPIC 1: The Importance of Process Improvement

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**1.1 "Reengineering of Supply Chain Process in Production Systems" -** *Case Study*
*Author(s):* Milan Radosevic, Milan Pasnla, Neinanja Berber, Neskovic Nebojsa, Branislav Nerandzic
http://web.b.ebscohost.com.ezproxy.lib.ucalgary.ca/ehost/detail/detail?vid=3&sid=136c78e0-9643-4d54-9668-ad3a6f9ca0b8%40sessionmgr120&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=bth&AN=86234882

"This paper presents a methodology for application of the Harvard Business School (HBS) for the implementation of reengineering project in the food industry in the procurement process"
Steps of Analysis:

1. Analysis of financial indicators before BPI
2. The implementation of BPI
3. Analysis of financial indicators after BPI implementation
4. Non-financial performances

Due to privacy reasons, the real company name is protected and will be referred to as "SFC", but it is known that the company is in the food industry.

Table 1 shows data about the company's efficiencies in the current state (step 1 of the analysis) and will later be compared to the analysis after the implementation of the BPI. The difference between the two analysis' will show the importance of process improvement.

Comparison between figure 2 and 3 shows change in the relationship between company and supplier, in figure 3 ("SCM process after BPI implementation") they are improving the process through implementing a more collaborative approach. Additionally, the large circle surrounding figure 3 represents ERP softwares again, improving collaboration by combining information on all participants of the chain.

Table 2 shows company data after the BPI has been implemented and the comparison with the company before BPI was implemented. Company managed to:

- Stocks of finished goods: Decrease from 10 to 6 days → improvement of 40%
- Stock of materials: Decrease from 20 to 15 days → improvement of 25%
- Inventories of raw materials: Decrease from 45 to 38 days → improvement of 16%

Additionally, by increasing the efficiencies of production lines, the time required to change tools was reduced by 30%, lost sales were reduced from 12% to 7%, inventory write-off reduced by 45%, warehouse rental costs reduced by 15% (due to less stock), and transportation costs reduced by 21%.

This case study shows the benefits that business process improvements can have on a company. The comparisons between data before and after a BPI has been implemented show the cost benefits but in addition to the financial indicators, the BPI has also allowed for more efficient communication between supply chain processes which leads to greater efficiency.

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**1.2 "Why Business Process Improvement is Still Important" -** *Blog*
*Author(s): Scott A. Holter*

http://blog.meadenmoore.com/blog/erp/why-business-process-improvement-is-still-important

Businesses have the tendency to focus their attention on features that could enhance their ERP systems. The author of this article argues that we should divert our attention back to the basics and really begin to understand the business process.

Scott A Holter describes business processes as “a clear road map [that helps to] define your ERP application requirements.” Business processes focus on getting a business from start to finish in the best most efficient way possible. Additionally, people are described as “the drivers of your business vehicles. The ERP system provides the horsepower. Business processes are the missing element, the map, that guides the driver to where they are going.” Without this map you can’t tell where you are, where you are heading, or if you’re even headed in the right direction, which for obvious reasons can be a big issue.

*“Improved Business Processes = Better Customer Service = Profitable Growth”*

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**1.3 “Why do we need a Continuous Improvement program” -** *Article*
*Author(s):* Scott Ambler
http://www.disciplinedagiledelivery.com/why-continuous-improvement/

Continuous improvement programs are needed in organizations to reduce the time to get an idea to implementation, to increase skill and knowledge sharing, to maximize your “failure ROI,” and to make radical improvements. Improvement ideas can come from any of the workers in an organization at anytime, it’s important to have a program in place to get those ideas out to the people who can implement the changes quickly. This leads to the high collaboration environment that is needed for an effective organization; suddenly with strong communication and sharing of lessons, employees will be motivated to learn from each other and share with those outside their immediate teams. This means faster problem solving because teams that run into similar problems will have solutions outlined by the people who already found those solutions. Continuous improvement means more searching for better changes; effectively increasing the chances of coming across breakthrough improvements and solutions.

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**1.4 “When Is Process Improvement Strategically Important?” -** *Article*
*Author(s):* Brad Power
https://hbr.org/2010/10/i-admit-im-a-process
Although process improvement is key to maintain fitness within industry, there are times when process improvement is not needed. Knowing when and where to implement process improvement is needed to avoid failure; that is, improvement programs should not focus on process that are not in need of improvement. For example, companies with breakthrough products, such as a patented drug, can be very inefficient and still be successful. Companies like Google, Apple, and Nike compete on offering the latest products, so they do not need to focus on making every process better; the process they need to focus on is product development.

Since knowing where and when to implement process improvement programs is critical, there is a framework to help identify the strategic relevance of improving such processes. The framework lists relevance according to the objective--earnings vs. growth--and the time frame--short term vs. long term. For example, if a process improvement has an earnings

objective with a short term time frame, it is considered medium relevance. The opportunities for improving such a process would be cost reduction and customer service/retention. This is much different than a long term, growth objective--which is placed at high relevance--because the opportunities of improving this type of process would be large scale; for example these opportunities would be new infrastructure platforms, integration (one company), merger and acquisition integration, and customer service/retention.

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## TOPIC 2: Improvement vs Innovation/Design

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**2.1 "Knowing the Difference Between Innovation vs. Improvement" -** *Article*
*Author(s):* Ruth Henderson
https://www.huffingtonpost.com/ellevate/knowing-the-difference-be_b_10226908.html

Not knowing the difference between innovation and improvement is a major issue due to failure in clarity of employee expectations. Employees can not meet expectations if they do not know what is expected of them. For example, what is required of a "Innovation & Improvement team?" Are they required to increase a company's efficiency or are they required to make the company an industry leader through groundbreaking change?

In this article, focus will be on the main differences between innovation and improvement. And explore the importances of being able to distinguish between the two. In many cases the words are used synonymously but there are some key differences that managers should know about.

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**2.2 "Tesla's Production Efficiency: The Next Moving Assembly Line" -** *Article*
*Author(s): Sam Korus*
https://ark-invest.com/research/tesla-production-efficiency

This article is about the moving assembly lines Henry Ford introduced to his factories that revolutionized the industry of transportation. We see the difference in improvement vs innovation because this was not the introduction of a new product or in this case a new model of car, it was a change to the production line of pre existing cars that skyrocketed efficiency and ultimately changed the the dynamics of the industry completely.

Ford's introduction of moving assembly lines allowed him to leave competitors in the dust. For the past 100 years these systems have barely improved and by 1929 the industry hit a ceiling and since then we have seen very little increase in the amount of vehicles produced by per worker. Today we have higher quality vehicles, but the assembly line process used to manufacture these vehicles, have barely changed.

Additionally, this article will look into Tesla's integration of robotics and this will be what determines Tesla's productivity. The success of this method production efficiency would improve immensely without having to increase the number of employees.  Elon Musk notes that employees are the ones that will be "maintaining machines and upgrading the machines and dealing with anomalies. And the output per person will be extraordinarily high."

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**2.3 "Amazon Drones Could Deliver a Package in Under Thirty Minutes for One Dollar" -** *Article*
*Author(s):* Tasha Keeney
https://ark-invest.com/research/amazon-drone-delivery

If Amazon can complete the implementation of drone delivery, packages that weigh 5 pounds can be delivered at a cost to consumers of $1, thus yielding a 50% internal rate of return for Amazon on this UAV investment. With the low cost of just $0.88 to deliver the 5 pound package, Amazon can expect margins that will allow for the company to break even just after one year. The costs of delivery services such as UPS and FedEX are 8-13 times as much than what Amazon is and their delivery times are far longer. Not only will customers enjoy the low costs, they will receive their packages much sooner too.

When first announced, Amazon's drone package delivery was mocked. But as the project reaches its final stages it might ultimately disrupt the industry of traditional package delivery. This Article will explore the convenience and low cost consumers can enjoy with the innovative implementation of Amazon drones.

*Additional sources for more information on laws and regulations of the drones:*

- **"Drone Deliveries, Machine Learning, The Bitfinex Hack, and More Takeaways from the Last Week's Brainstorming" -** *Article*
  *Author(s):* ARK Invest
  https://ark-invest.com/research/amazon-drone-delivery*https://ark-invest.com/research/drone-deliveries-machine-learning-the-bitfinex-hack-and-more*
  Refer to "1. Commercial Drone Deliveries Are On the Horizon" for information on drone implementation in 2016 - approval of non-line-of-site testing
- **"Deliveries Get Closer With Trump's Executive Order" -** *Article*
  *Author(s):* Alan Levin
  *https://www.bloomberg.com/news/articles/2017-10-25/amazon-s-dream-of-drone-deliveries-get-closer-with-trump-order*
  For further information on drone implementation in 2017 - Trump signs order that will allow companies to apply to the FFA letting them tests for drone deliveries, and air-traffic systems etc.

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**2.4 "Need Radical Innovation and Continuous Improvement? Integrate Process Reengineering and TQM" -** *Article*
*Author(s):* Thomas H. Davenport
http://www.emeraldinsight.com/doi/pdfplus/10.1108/eb054413 (Pages 6-11)

Reengineering--also known as process innovation and redesign--is an approach with a focus on more radical process changes; commonly compared to reengineering, is continuous improvement programs--also known as total quality management (TQM). It is the goal of many firms today to understand the relation between the two approaches and to integrate them into a single program. Similarities between the two are that both approaches base their analysis' on processes, both require significant organizational and behavioural change, and require a substantial investment in time to be successful. The differences--which are greater than similarities--are the goals of each approach, which affects the point that the techniques approach the process, the participation level of the approach, and the value placed on the variation of the investigated process. Innovation programs strive for radical changes, so it urges participants to imagine starting from a clean slate, and wants to identify the factors that maximize variation to create large scale changes. Improvement programs on the other hand, are focused on small continuous changes, and so it starts from the current state of the process, and chips away at it. Improvement programs are also highly participative, and stresses process control to minimize unexplained variation in a process.

Unless process improvement and redesign techniques are integrated in the organization, employees become confused about the differences between change programs. It can also be demoralizing for the participants of the change team, and the wrong techniques may be applied; this is very dangerous to the organization. If employees misunderstand the differences between improvement and innovation, they may try using innovation approaches for low level improvements; which would be overkill. Likewise, if they use improvement approaches to achieve radical changes, their team is destined to fail. So, to avoid these issues, there are four approaches to integrating improvement and innovation activities within firms: Sequencing change initiatives, creating a portfolio of process change programs, limiting the scope of work design, and undertaking improvement through innovation. These approaches are not exclusive, one large firm might even want to employ all four.

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**2.5 "Dynamic Capabilities and Organizational Ability: Risk, Uncertainty, and Strategy in the Innovation Economy" -** *Article*
*Author(s):* David Teece, Margaret Peteraf, Sohvi Leih
http://journals.sagepub.com/doi/pdf/10.1525/cmr.2016.58.4.13

"Organizational agility," is commonly expressed as the solution for all firms; often considered as the impenetrable shield against the ferocious industries filled with competition. However, while it may be needed, the transformations undergone by organizational agility comes with a price. It should be noted that transformations might not be necessary, or even possible. Which is why it is important to understand agility in relation to dynamic capabilities; from there the need for understanding deep uncertainty is truly highlighted. Deep uncertainty is ubiquitous in economies that are connected, interdependent, and experiencing technological change. It is more important to do the right things than to do things right under conditions of uncertainty. William Janeway noted "a market mechanism for hedging the sort of ontological uncertainty [...] has never existed, is unlikely to ever exist, and will not persist if someone is foolish enough to create it." The framework offered to managers, given the absence of hedging mechanisms, is dynamic capabilities.
The level of uncertainty in the industrial economy to that in the new (innovative) economy, can be closely compared to chess versus mixed martial arts. In chess, the better player almost always wins, almost every move is knowable, and there is a finite number of moves and countermoves. Mixed martial arts on the other hand, is more open, participants cross-train in a variety of styles to counter their opponent's strength and remain effective in all phases of combat. The fighter has tools such as kicks, knees, and punches which can be combined with anything else a boxer or wrestler must use. Techniques are not expected, fighters wait without anticipation for whatever happens, and upsets are very common. Chess has elements of managing risks; managing uncertainty is more like mixed martial arts.
Strong dynamic capabilities are necessary for stimulating the organizational agility that is needed to address deep uncertainty. A firm's dynamic capabilities defines its ability to innovate, adapt, and create change internally and externally. Dynamic capabilities are broken into three primary clusters: sensing, seizing and transforming. A study on the role of managerial cognition and human capital in the dynamic capabilities framework, showed that the top management team and CEO's ability to sense a key development, and then respond, is critical to the firm's dynamic capabilities. That being said, the strength of the firm's dynamic capabilities also relies on the organizational culture, values, and collective ability to quickly implement new models. Therefore organizational structure, as one can imagine, also affects the strengths and weaknesses of a firm's dynamic capabilities.

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## TOPIC 3: Linkages with TQM and JIT

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### 3.1 "Total Quality Management & Just In Time" - *Article*

*Author(s):* Gagan Pardeep
https://www.slideshare.net/GaganSharma3/tqm-jit

TQM is a method that is focused on prioritizing quality. Some principles of TQM would include, continuous improvement, commitment of top management, and using a proactive systematic approach. On top of that, TQM has five building blocks, also known as the 5Ps. JIT systems are aimed towards eliminating production wastes by only producing what is needed at the right place and time. The main goal of JIT systems is to minimize the presence of operations that do not add value.

The two methods are mutually supportive and should be used together. TQM allows for a reduction in rework time that will improve levels of quality. This minimizes the need for safety stock thus improving JIT performance. In turn, JIT provides TQM with improved feedback of processes and problem exposure. The main take away from this paper is that TQM and JIT should not be treated as separate business strategies, but instead be used hand in hand.

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### 3.2 "Analyzing top examples of just in time inventory and production management" - *Blog*

https://davidkigerinfo.wordpress.com/2017/05/17/four-significant-cases-of-companies-using-the-just-in-time-system/
**"Four significant cases of companies using the Just in Time system"** - Blog
https://davidkigerinfo.wordpress.com/2016/02/22/analyzing-top-examples-of-just-in-time-inventory-and-production-management/
*Author(s):* David Kiger
*(Due to similarities in the blogs, summary will be on a combination of both)*

Companies that involve inventory management and manufacturing have been evolving over the years. Toyota changed the game with the introduction of Just-in-Time (JIT) systems. This system is recognized as the optimal way to manufacture a product.
These two blogs will focus on Toyota and how it has organized its process so that it can use what it needs when it is needed in order to minimize the amount of waste produced.

An important thing to keep in mind while reading these blogs are the linkages between TQM and JIT. The JIT strategy is the ability to continuously improve the process. This allows for increased profits, lower wastes, better customer responsiveness, but most importantly higher quality products. JIT allows for TQM to prevent errors rather than correcting them after they have occurred (which costs money). Additionally, TQM minimizes defects in the final result which ultimately enhances JIT systems by decreasing the need for additional safety stock.
Other examples of company uses of JIT systems included in these articles:

- Dell
- Harley Davidson
- McDonald's

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### 3.3 "Lean Production at McDonald's" - *Blog*

*Author(s):* "mrunal"
http://cmuscm.blogspot.ca/2014/09/lean-production-at-mcdonalds.html
**"What Can A Manufacturing Plant Learn from McDonald's?" -** *Article*
*Author(s):* Unknown
http://valuestreamguru.com/what-can-a-manufacturing-plant-learn-from-mcdonald%E2%80%99s/

*"McDonald's is about efficiency without sacrificing quality, speed, again without sacrificing quality and finally it is about consistency."*

This article focuses on the idea that McDonald's is just a mini manufacturing plant, and that larger plants can actually learn quite a bit from McDonald's operations. Some core fundamentals that McDonald's strives towards would include:

- Standardization
- JIT Production
- Flexible and Multi-skilled Workforce
- Lean Production
- A Production Process Approach

Because McDonald's is a fast food chain and is focused on getting their food out to customers as fast as possible why wouldn't they start by making 1,000 cheese burgers in the morning and keep them warm until they're sold off?

1. It would take up a lot of room
2. Costs of resources to keep the burgers warm
3. They might not all be sold

Earlier McDonald's actually used to make their sandwiches in batches and then use bins to keep them warm, giving McDonald's a bad reputation of being wasteful. These two sources will focus on how McDonald's came about minimizing the amount of wastes they produced and ultimately adopting principles of lean production.

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**3.4 "Kanban: Toyota to Software Development in 2 minutes" -** *Video*
*Author(s):* Nathalia Soeira
https://www.youtube.com/watch?v=5izyN66PTxs

In an ideal world machines work simultaneously and at the same pace. In the real world this is not the case, which can create an overflow of work in progress (WIP). To reduce waste, speed up cycle time, and speed up throughput time, the "Kanban-pull" model is introduced. Instead of having an overflow of WIP, the system only operates when the successor process is ready to receive work.

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**3.5 "Relationships between implementation of TQM, JIT, and TPM and manufacturing performance" -** *Case Study*
*Author(s):* Kristy O. Cua, Kathleen E. McKone, Roger G. Schroeder
http://www.business.uzh.ch/professorships/som/stu/Teaching/FS10/MA/som/Cua_2001_practices.pdf

Although this article includes Total Productive Maintenance (TPM), it states the importance of not only researching TQM and JIT together, but implementing them together, and the relationships between them. The paper “examines these manufacturing practices within a single theoretical framework. The goal is to identify the differences between high and low performing manufacturing plants with respect to their implementation of TQM, JIT, and TPM practices.

Figure 1 shows the relationships between the basic TQM, JIT, and TPM techniques by highlighting the unique and common practices between all programs. The TQM basic techniques--cross-functional product design, process management, supplier quality management, and customer involvement--can be better distinguished from the JIT techniques--setup time reduction, pull system production, JIT delivery by suppliers, equipment layout, and daily schedule adherence--in this visual. The human and strategic-oriented common practices are committed leadership, strategic planning, cross-functional training, employee involvement, and the need for information and feedback. This then leads to the “socio-technical systems theory.”

As shown in figure 2, the socio-technical systems theory takes the unique and common practices, and bases the level of performance in a manufacturing plant on the implementation of these socio-oriented and technically-oriented techniques. It is argued that building manufacturing competitiveness upon the integration and coordination of strategy, structure, culture, and human resource subsystems is crucial for the success of transplants in a complex, changing environment. Therefore many researchers have concluded it is important to ensure “fit” within your organization--the consistency of relevant factors--to increase performance. However, the article argues that high performing manufacturing plants implement practices from all three programs; although different configurations of unique and common practices affect specific measures of performance, the simultaneous implementation of all programs will result in a higher performance than the implementation of only one program.

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## TOPIC 4: Theory of Inventive Problem Solving (TRIZ)

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**4.1 "Converted Farm Machine Improves Boeing Production Process" -** *Article*
*Author(s):* Cheryl Addams
http://boeing.mediaroom.com/2003-07-01-Converted-Farm-Machine-Improves-Boeing-Production-Process

This article discusses the implementation of TRIZ at Boeing. The example in this article shows how creative problem solving can be as simple as borrowing an idea from another industry. Asking one's self, "who else has had this problem, and how did they solve it?" is the main point of the story in this article.

In 2001 Larry Larson and Bob Harms were part of an innovative factory team called the "Moonshine Shop" at The Boeing Company. Their mission was to find a simpler way to lift heavy parts, like passenger seats from the factory floor to the 757 airplane door. Using TRIZ, the two went out looking for existing methods that they could adapt to solve their own problem. Looking at ferris wheels, ski lifts, roofing material loaders, and how sugar beets are loaded, the two eventually started to consider farm equipment. Larson and Harms ran into the hay loader, and made minor modifications to adapt it to the factory's needs. This adaptation reduced the resources needed by removing the use of cranes. The time to accomplish the task was reduced from 12 hours to 2 hours, and the modified hay loader concept has been moved to work on other planes such as the 737, 767 and 777. The concept is still used by Boeing today, and shows the implementation of TRIZ.

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**4.2 "TRIZ in the Pharmaceutical Industry" -** *Article*
*Author(s):* Akhilesh Gulati
https://www.qualitydigest.com/inside/quality-insider-column/triz-pharmaceutical-industry.html#

The following article is within the medical industry, which shows that TRIZ can work in any environment. Two cases were analyzed, eye medication and shipping proteins. Instead of having eye drops that just run out of the eyeball or into the cul-de-sac of the eye, the manufacturers used the principle of "change parameters" to overcome the contradiction. The contradiction being, a "physical" contradiction, which just means that the physical state of the product is contradictory to how the desired state would be imagined. So for the eye medication example, the goal is to have the medication sit inside the eye for as long as possible to heal more effectively, however, the physical state of the medication (liquid) runs out of the eyeball very quickly. So one might think to make the medication solid, however that would make it very difficult, if not impossible to apply to the eyeball, which is where the physical contradiction lies. By using the principles of TRIZ, specifically the "separation of contradictory properties in time" and the "separation of contradictory properties in space," the answer to problem was made clear. The solution to this contradiction is a formula that allows the eye drop to take a liquid form while sitting and being released from the dropper, but is activated by body temperature to bind with the tears to form a gel that lasts in the eye.

The shipping protein is another example of a physical contradiction. The protein needs to be in liquid form in order to be used easily, but are difficult to transport in this form because they are unstable and have a short shelf life. However, if the proteins were solid these concerns would be greatly reduced. The solution is to freeze-dry the protein material and ship it in dry powder form, and then reestablish it at the point of use as a liquid. This case can make the concept of the "Ideal Final Result" in TRIZ more understanding.

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**4.3 "What is TRIZ and How can it be used in Problem Solving or Brainstorming" -** *Article*
*Author(s):* InnovationTools.com
http://www.innovationmanagement.se/imtool-articles/what-is-triz-and-how-can-it-be-used-in-problem-solving-or-brainstorming/

This article is about gaining a more general understanding of the "Theory of Inventive Problem Solving" (TRIZ) technique. The article gives a brief summary of the origins of TRIZ, the development of TRIZ, the "Inventive Principles" of TRIZ, the "Separation Principles" of TRIZ, and the patterns of problem solving. Rather than explaining each specific principle, the article describes and explains why the principles are categorized the way they are. For example, the article tells us about "40 Inventive Principles," rather than describing each one, we are told about "operational and design contradictions." If the design or operational characteristic contradiction is resolved, it is considered a breakthrough invention (rather than an incremental invention).

After a detailed discussion of TRIZ, the article offers a conclusion for the the use of TRIZ. "TRIZ is a science not a psychology," as described by the article. The use of TRIZ will not magically make problems disappear, it is a method for problem solving; because of that, TRIZ needs practice and discipline to be successful. "Inventiveness" is not inherited, it is a skill, which means it can be learned. Using the right method while learning will increase your chances at making something truly groundbreaking. TRIZ is the technique that encourages you to fix contradictions, rather than compromise and avoid them.

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**4.4 "Where Does TRIZ Fit Within Our Growing Organizational Practices for Innovation?" -** *Blog*
*Author(s):* Paul Hobcraft
https://blog.hypeinnovation.com/where-does-triz-fit-within-our-growing-organizational-practices-for-innovation

The information covered in this blog posting is quite vast and diverse. Before the discussion of the Theory of Inventive Problem Solving (TRIZ) is made, there is a discussion on some of the other popular problem-solving methods. A contrast is then drawn from a story of the evolution of problem-solving. The information presented briefly describes these different techniques to build a context for the importance of TRIZ. For example, we are briefed on internal control mechanisms such as Total Quality Management (TQM), Just in Time (JIT), and Six Sigma; then we are introduced to Customer Experience (CX), as well as some other external focuses of the organization. The result is a better understanding of how TRIZ can fit into the mix of the problem-solving tools already available.

The blog then goes into more depth on TRIZ, and really attempts to create an understanding of how it can be used more practically. First, the essential characteristics of TRIZ are

presented. For example, TRIZ relies on the study of the patterns of problems and solutions, not on the intuitive creativity of certain people. Another distinct part of TRIZ, is the “40 innovative principles,” and recognition that “contradictions” always have a root cause. The blog then describes the research behind TRIZ, and how effective it has been. The discussion is then finished off with a recommendation on how to use TRIZ; as well as the other problem solving methods that should be combined with TRIZ for optimal use.

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## TOPIC 5: Clustering/Affinity Diagrams

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**5.1 "The Predictive Power of Social Media" -** *Article*
*Author(s):* Dan Woods
https://www.forbes.com/2010/07/26/cluster-analysis-predictions-technology-social-media.html

Clustering uses a statistical approach where documents are read then words are analyzed and tracked to determine their relation with other words. Clustering is a game of probability that will ask questions like, "How probable is it that this word is next to that one? How unlikely?" this analysis allows for the discovery of patterns and relationships in the data.

This article dives into the discovery of "unknown unknowns", what they mean, and how they differ from "Known unknowns". Cluster analysis' will inform you of what clusters are getting stronger or weaker, but it will not tell you what these clusters mean. Clusters that get increasingly stronger have potential to let us forecast future trends; Forbes uses the music industry as an example.

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**5.2 "The Affinity Diagram Tool" -** *Article*
*Author(s):* Unknown "Admin"
*http://www.sixsigmadaily.com/the-affinity-diagram-tool/*

An Affinity Diagram also known as the K-J method (developed by Jiro Kawakita) is an analytical tool that can be used to organize multiple ideas by commonality. By organizing ideas into subgroups it is far easier to visualize common themes and relationships.

**Example 1:** shows an example of how an affinity diagram organizes brainstormed ideas into clear categories based on commonality.

**Steps**:

1. Write down problems (*Note that this is a brainstorming session that should be done non-vocally, this prevents individual ideas from being turned down eliminating possibly biases)*
2. Put into homogenous groups
3. Apply an affinity heading
4. Put groups into order in accordance to the process

*Article goes into further detail about these steps and shows example or different problems being groups into groups and then organizing them by process.*

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**5.3 "Basic Tools for Process Improvement: Affinity Diagram" -** *Article*
*Author(s): Unknown*
http://www.balancedscorecard.org/portals/0/pdf/affinity.pdf

An affinity diagram groups large amounts of data based on similarities, the data that is used is usually a product of brainstorming ideas. Affinity diagrams are useful for creative thinking, making it a good choice for approaching difficult and unexplored problems. It is then important to note that the affinity process is especially useful in two cases, when sifting through large volumes of data, and when you want to encourage new patterns of thinking. However, there are times that the affinity process should not be used, this is for problems with very little information pieces; as a rule of thumb, less than 15 items of information is not enough.

The process is performed by a group, usually five or six members works best. The unique features of the Affinity Process are:

- Affinitize silently: Members move the displayed ideas without talking. Encourages unconventional thinking and discourages semantic battles.
- Go for gut reactions: Members should react quickly to what they see, speed rather than deliberation.
- Handle disagreements simply: If a member disagrees where an idea is grouped, he or she moves it. Creates a disagreement friendly environment and differing viewpoints. If consensus cannot be reached, duplicate the idea and place one copy in each group.

The step-by-step process of creating an affinity diagram:
Step 1 - Generate ideas
Step 2 - Display ideas
Step 3 - Sort ideas into groups
Step 4 - Create header cards
Step 5 - Draw finished diagram

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## TOPIC 6: Framework for Process Improvement

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**6.1 "Could Deep Learning Grow the Robotics Market Ten-Fold (or More)?" -** *Article*
*Author(s):* James Wang
https://ark-invest.com/research/deep-learning-grow-robotics

Deep learning is transforming our traditional robots into ones that have the ability to learn from the data it retains over time and from the experiences it encounters. This allows for these robots to perform new tasks and are not restricted to repetitive and predictable ones. This article talks about the growing potential of robots with deep learning capabilities and their ability to soon replace the more traditional industrial robots we have today. Today's robots require expert programming along with heavy duty fixtures and safety cages. The robot industry is working towards a new breed of robot that is designed to work with and alongside humans. The industrial robots that we have now require their processes to be broken down and programmed into a series of movements, they do not obtain the ability to learn.

The article will go more in depth into why deep learning is such an effective method. It is much faster to have a robot learn a task than to have a programmer teach a robot a task. This difference is quite significant as it only takes 8 hours for a robot to learn a task through deep learning whereas having a programmer to teach it the same task would take multiple days. Deep learning has the ability to drastically change the market for robots. These new co-operative robots can perform a wider range of tasks in comparison to the traditional robot, that would need to be locked up in safety cages, while also requiring high level programming to perform basic mundane tasks.

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**6.2 "Six Sigma and Innovation - A Remarkable Duo" -** *Article*
*Author(s):* Alex Orlov
http://innovationexcellence.com/blog/2012/04/11/six-sigma-and-innovation-a-remarkable-duo/

Innovation and Six Sigma are clearly different methodologies but "If we look at the picture as a whole, the goal is to innovate and Six Sigma is a method that will aid the process of identifying both problem causes and feasible solutions."
Innovation is not a requirement for improvement.

**Six Sigma (DMAIC) Process:**

- DEFINE - identity the problem
- MEASURE - use statistical tools to measure current states and compare them to a calculated final goal
- ANALYZE - thinking/brainstorming
- IMPROVE - After the main defect is thoroughly understood, you can start finding a method or solution to reduce the defect
- CONTROL - monitor and ensure that the improvement plan is closely followed

**Tools used in the process:**

- Root Cause Analysis (RCA)

- Voice of the Customer (VOC)
- Process Mapping (PM)
- Quality Function Deployment (QFD)
- Failure Mode Effects and Analysis (FMEA)
- Value Engineering Analysis (VEA)
- XY Matrix, TRIZ method (Theory of Inventive Problem Solving)
- PUGH Matrix selection
- Design of Experiment (DOE)
- Robust Design and
- Mistake Proofing

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**6.3 "Lean Innovation at Amazon" -** *Blog*
*Author(s):* Geovanny Romero
http://innovationexcellence.com/blog/2014/09/22/lean-innovation-at-amazon/

This article shows the ways Amazon implements lean innovation into its business model. Amazon has already implemented lean innovation through its use of automation, but this article will focus on the lean innovation of "standard work" and how this process can be altered to reduce the amount of waste produced and increase the efficiency of production. It looks at "**Kaizen in the fulfillment center"** and their role in continuous improvement at Amazon as well as "**Pulling the andon cord**", a method used to empower front line employees while decreasing the amount of defects.

**Next frontiers**
The next step for Amazon is to implement lean-management practices to software creation. An issue Amazon is facing at the moment is software engineers do not yet have the ability to detect the defects in real time (during development). "Testing" only happens once the product is completed and the customer is the tester.

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**6.4 "Kaizen with Six Sigma Ensures Continuous Improvement" -** *Article & Case Study*
*Author(s):* Afsar Choudhury
https://www.isixsigma.com/methodology/kaizen/kaizen-six-sigma-ensures-continuous-improvement/

Kaizen is a philosophy that is focused on improving all aspects of a workplace and ultimately eliminating waste is all systems. This article will summarize what a Kaizen is, how it can be implemented, and the benefits of using Kaizen alongside Six Sigma.

CASE STUDY: Reducing Sampling Time - this case study will look at the importance of combining six sigma processes with kaizen activities.

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## TOPIC 7: Establishing Appropriate Organizational Support

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**7.1 "Google's Best New Innovation: Rules Around '20% Time'" -** *Article*
*Author(s):* Kotter International (contributor)
https://www.forbes.com/sites/johnkotter/2013/08/21/googles-best-new-innovation-rules-around-20-time/

This article will talk about Google's infamously known 20% rule, and the more recent changes they have made to ensure innovation continues to drive the company forward. **"Urgency without alignment is wasted energy"** and that is exactly what will be further explored here. These newly implemented rules will allow for company goals to be properly defined, but not to the point that innovation is impeded. This "focused free-thinking" changes the company dynamic by allowing employees to direct their innovative and imaginative creativity towards Google's strategic goals.

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**7.2 "How to create a culture and structure for innovation" -** *Article*
*Author(s):* Craig Silverman
https://www.americanpressinstitute.org/publications/reports/strategy-studies/culture-and-structure-for-innovation/

Managers of successful innovative companies are focused on creating a culture that fosters innovation over a culture that is administratively efficient. Innovation comes from the desire to experiment. "You look at any of these organizations that are doing a good job with innovating in design or media and it usually is the case that their organization and culture is set up in a way that is not the norm." According to research, existing organizational structures have been recognized as one of the primary barriers in allowing real change to occur. This article will focus on the importance of building appropriate organizational support for innovative growth.

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**7.3 "Building a Culture that Thrives on Innovation Agility" -** *Article*
*Author(s):* Janet Sernack
http://innovationexcellence.com/blog/2017/03/24/building-a-culture-that-thrives-on-innovation-agility/

In today's day and age of disruption, accelerating innovation is necessary to facilitate a company's competitive advantage or just to ensure survival. The article calls this "The

Conceptual Age" where attention needs to be derived towards "enhancing creativity, agility and in developing customer empathy". Organizations that can do this, create an environment where knowledge workers can thrive, and know how to think and act differently within an agile and innovative culture. This article will explore the importance of creating this environment because those that thrive in an agile innovation culture are capable of regulating their unconscious resistance to change.

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## TOPIC 8: Selecting Appropriate Processes to Investigate

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**8.1 "Innovating on the Critical Path" -** *Article*
*Author(s):* Mike Shipulski
http://innovationexcellence.com/blog/2016/04/12/innovating-on-the-critical-path/

The most challenging thing while working on a project is deciding what task should be worked on first, and after that is complete, what task should follow. Reason being is if a task on the critical path is delayed the whole project is delayed. The main take away from this article will be **"If you don't know the critical path, you know know very much"**. Additionally, the article will further explore six ground rules when it comes down to innovating on the critical path.

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**8.2 "Netflix's Distribution And Interconnections: What Are The Economics Today?" -** *Article*
*Author(s):* Pascal Stegmann
https://ark-invest.com/research/cdns-netflix-networks

Netflix is the highest volume producer and accounts for 35% of total internet traffic, this is 20% more than YouTube, which is second highest. We can consider the distribution of content as a process. Within this process, our primary bottleneck would be the significant delays as media travels through interconnected networks. Netflix's solution to resolve this bottleneck is actually what gives them their competitive advantage. As you will see in the article, Netflix is able to pay distribution fees lower than $0.02 per GB and deliver content worth $3 billion.

Netflix has invested in programs, such as Open Connect, to better its negotiating power with third party content delivery networks and internet service providers. At the moment, Netflix is paying roughly $0.12 per customer a month to obtain sufficient traffic capacity. However, this has the potential to change when the demand for 4K content starts to increase, because the bandwidth required will be 5 times more. Netflix will have to start deciding how much it will be willing to pay for these network traffic routes. In this article you will see more on how Netflix balances its distribution costs and content acquisition/production to acquire its 42% - 49% contribution margin.

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**8.3 "How Blockchain Technology Can Enhance Electronic Health Record (EHR) Operability" -** *Article*
*Author(s):* Christopher Burniske
https://ark-invest.com/research/blockchain-technology-ehr

Healthcare has been subject to many shortcomings over the past century. The attempt to make healthcare more affordable through innovations such as the Affordable Care Act, the Social Security Act, Health Maintenance Organizations Act, and employer sponsored coverage have all brought forth negative results. Despite the many efforts, the national health care expenditure is still increasing, with analysts predicting that it will continue to grow annually by 5.8% till 2025. If this holds true, the national health expenditure will make up roughly 20% of GDP.

This article will explore the potential benefits that blockchain can bring to the medical field. By looking at Bitcoin's blockchain technology, we see that bitcoin transactions are just another method of exchanging data. Because medical information private, this opens up doors to potentially transferring medical data in a secure manner. The question is, despite the many past shortcomings, will blockchain technology "succeed where past innovations have failed?"

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## TOPIC 9: Benchmarking

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**9.1 "Optimizing Airplane Maintenance Economics" -** *Case Study*
*Author(s):* Tom Buyers
http://www.mdc.com/commercial/aeromagazine/articles/qtr_01_10/pdfs/AERO_Q1-10_article02.pdf

The Technical Operations Performance Improvement and Cost Solutions (TOPICS) is teamed up with airlines, such as boeing, to provide methods for cost reduction, and performance maximization. In 2005, Boeing started searching for ways to improve maintenance operations and increase profitability for customer airlines. However, at the time there was no industry standard to compare against, which led to the development of TOPICS working groups. TOPICS provides the venue to benchmark the maintenance cost of participating airlines, enabling each airline to compare itself against others. This provides a baseline for improvement, as companies can now see comparisons within industry. "TOPICS is also an open forum that allows members to share maintence cost-related challenges, success, and opportunities with each other." It is a means for all stakeholders to participate in the process of business improvement.

Figure 4: Examples from a tailored maintenance cost benchmarking report, showcases a few great examples of how benchmarking has helped airlines not only identify problems, but improve operations and find solutions for those issues. For example, a TOPICS benchmarking report on the average maintenance cost per flight hour, pointed out an airline was reporting costs of US$3.31; the average cost per flight hour in the industry was only US $1.44, prompting the airline with such high costs to implement a solution that significantly reduced its maintenance costs for this component. This airline would not have recognized such an issue if it was not part of the TOPICS work groups, furthermore, the airline would have missed out on potential savings of US$8 million in maintenance costs over 15 years from just one component.

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**9.2 "How Benchmarking Can Improve Cost Competitiveness in Steel" -** *Article*
*Author(s):* Toralf Hagenbruch and Benedikt Zeumer
https://www.mckinsey.com/industries/metals-and-mining/our-insights/how-benchmarking-can-improve-cost-competitiveness-in-steel

Steel producers have been competing on operational efficiency for years. The need for cost reduction is so important, that processes are always being reevaluated and improved. These needs come from a fiercely competitive industry, where all producers, internationally, are striking one another with cost reduction and profit maximization tactics. Along with the availability for low-cost global transportation and overcapacity in China, there has been a deterioration of average steel-industry revenues. 17 percent is the minimum earnings before interest, taxes, depreciation, and amortization (EBITDA) margin necessary for long term sustainability of the steel business; the average is far below, between 9 and 10 percent. Furthermore, the average capacity utilization was at only 69 percent globally in 2016; far below the healthy threshold of 80 percent.

It is clear that there are strong forces in the steel industry that threaten the wellbeing of many companies. To address these issues, steel producers need benchmarking as it is a great eye opener--providing steel companies an external perspective on how well certain

parts and process of the business are performing. Benchmarking can be used to set performance targets, and integrating it into the business can make for a competitive, performance oriented corporate culture.

However, there are distinct challenges with benchmarking, especially inside the steel industry. Before a company can design and implement an improvement to their operations, it will need to outline and understand the different issues surrounding its industry; in this case, the difficulties of benchmarking the steel industry. A few of the central challenges are:

- Growing degrees of freedom—what are the optimal operating points?
- Transparency as starting point—what performance levels do other steel producers achieve?
- Adjusting benchmarks to fit real boundary conditions—how can we avoid mixing up structural and performance differences?

To approach the benchmarking effort that faces these challenges, a three-step approach was designed for the steel industry: baselining, normalization and benchmarking, and opportunity sizing and prioritization (Exhibit 3). Exhibit 3 showcases the three-step process in order, with a description of the “main activities” and “end products” for each step. Baselining includes defining the reference period (Fiscal year, Quarter), collecting key performance indicators (KPIs), and ensuring a consistent definition of those KPIs. The normalizing and benchmarking step, should make KPIs consistent so that they are measurable, and make for structural and performance differences distinguishable. The final step, opportunity sizing and prioritization, defines KPI targets, quantifies the improvement opportunity, and prioritizes the improvement areas.

“One of the most important objectives of a comprehensive benchmarking project, including normalization and adjustments, is to create full transparency and a fact base of comparisons of actual performance data and a best-practice plant. This is crucial not only for the management team but also for the production teams and individual operators. Full transparency helps ensure buy-in to ambitious performance targets for operational KPIs that the production team can really influence. If this transparency is in place, operators typically demonstrate strong commitment and willingness to sign off on individual improvement measures with clearly defined KPI and financial-impact targets.”

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### 9.3 “Health Care Benchmarking” - *Paper*

*Author(s):* Mike Shipulski
http://www.fmshk.org/database/articles/06mbdrflkay.pdf

Benchmarking allows for organizations to understand their strengths and weaknesses, realize the level of performance they are on in comparison to others, and increasing competitive advantage against competitors. This paper alternatively focuses on healthcare benchmarking. One should hope the healthcare industry does not measure their success on profitability. For this reason benchmarking in the healthcare industry differs from those of other competitive industries. Instead of **competitive benchmarking** this paper will explore the benefits of **comparative benchmarking**, and how it removes the competitive side and focuses on what these healthcare companies have in common. This creates a space for greater potential learning and knowledge sharing. The paper also includes a great example about how benchmarking can recognize performance gaps and close these gaps to create a standard of care that is consistent across services.

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## TOPIC 10: Assembling the Team

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### 10.1 "How to Assemble the Perfect Work Team" - *Article*

*Author(s):* Aveta Business Institute
https://www.sixsigmaonline.org/six-sigma-training-certification-information/how-to-assemble-the-perfect-work-team/

Teams make up the business, and it can be seen that the business itself is a team striving for a common goal, increased profits and success. There are a few essential techniques managers should use when assembling a team. The first of which, determining why you need a team for the task and what the goals of the project are. Determining the scope of the project will provide a better understanding of the project to the manager, which helps with determining more specific aspects needed in the group. These aspects include, number of people needed, and the individual tasks of the project. As a side note, groups should be kept small, managing larger numbers can become extremely difficult very quickly; it is best for managers to choose individuals who can multi-task.

Once the role of each member is defined, the manager must start selecting individuals based on their qualifications to fit those roles. It is important to note, that employees must be good with working in groups; a highly qualified employee with extensive knowledge on a specific part of the project will cause more problems and difficulty for you if not suited for team work. Therefore, it is imperative to check the teamwork skills of every employee before selecting the team that you work with--as this will greatly reduce the risk of major team conflicts caused by poor quality team members. Another key to avoiding unnecessary conflicts is to delegate specific tasks to each member. This will ensure that workers don't step on each others toes, and that feelings will not be hurt; obviously this is important, as this type of behaviour can cause delays and an ultimate failure of the project, leaving the manager without a job.

It is important to recognize tested and true methods for assembling a team. Managers, if organized and proactive in their approach, can develop the the right teams for the right projects. Encouraging the team to work together in order to reach the final project goals is a continuous effort by the manager.

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### 10.2 "Developing High Performing Project Teams" - *Video*

*Author(s):* Stamford Global
https://youtu.be/EnC_MIJQHVQ

High performing teams are ones that do the job correctly and communicate well; however not as obviously, high performing teams have fun, have a way of solving problems, and do things together outside of work. These teams are dependant on the project manager and the parent organization, to facilitate the type of environment that promotes such activities and performance. The team goes through different phases; the team members meet for the first time and need to get to know one another. This phase requires lots of communication. After getting to know each other the team must build trust, not just with each other, but with the manager and the organization at large. Trust in job security, trust in being delegated tasks correctly, and trust in others to do their jobs too. After that stage has been reached, then there is the performing part. The performing part is where most of the conflicts arise, so there are elements that play in from the team leader and the team members to resolve

conflict. Then there is the “Ramp-down” stage, where the team members start to leave the project, often times, without the knowledge of the team leader. This then creates another problem for the leader, who needs to find a way to continue having a high performance team. So to avoid this problem, it was noted that members needed to have a sense of safety; feeling secure and cared for by the company would make them stay with the project. Members shouldn’t need to worry about coming back to their original departments after the project is completed, and finding themselves without a job.

The team has 4 different levels of performing; give, get, belong, and grow. The team members must be given supplies, tasks and organization before they can do anything for the project. Only after that phase, of receiving all the resources they need to do the job, can they go to the next layer. The next layer, get, means that now there is a willingness of members to do their jobs, and to communicate, this is when the project gets things back from the members. After that stage is achieved, the team can move on to the next layer, belong. Belonging is important for project success, as mentioned earlier, if the members do not feel secure, they might leave the project early out of fear of losing out on the original department which they came. The last step, grow, is where you really get a high performing team; where team members can grow and gain experience and knowledge that will further their careers. The project manager should encourage team members to learn new technical skills, and the company should take care of the personal career development of the members, to ensure high performance from the project team.

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**10.3 “The Five Stages of Project Team Development” -** *Article*
*Author(s):* Project-Management.com
https://project-management.com/the-five-stages-of-project-team-development/

Every team will go through the following 5 stages, forming, storming, norming, performing, and adjourning. The first four stages are known as “Tuckman’s Stages,” and the adjourning stage was added later.

Stage 1: Forming
Team first meets each other and everyone is introduced. They are not working on the project yet, they are “feeling each other out” and finding out how they might work together. During this stage, the team leader should be clear on the team goals, and provide clear direction regarding the project.

Stage 2: Storming
As the team begins to work together, they will start to run into conflicts. This is an unavoidable and important stage in developing a cohesive team; the team members compete with each other for status and acceptance of their ideas. As mentioned numerous times, diverse thinking provides a base for innovative business process improvements; it also means more differences in opinions which is a base for conflicts.

Stage 3: Norming
Members start to work more effectively as a team, focus shifts from individual goals to processes and procedures on working together. Team begins to trust each other and actively seek each other out for assistance and input. Significant progress is made as teamwork is more effective, and the team leader will have less involvement as the team starts to self-direct with more empowerment to resolve issues on their own.

Stage 4: Performing

The members will be functioning at a very high level. The team leader shifts to more of a monitoring role now that the team can come to its own agreements on problem solving, and day-to-day activities. The team can revert back to one of the earlier stages if, for example, one of the members starts to work independently, or if new members are added. It is the role of the leader to facilitate the needs of the team, and keep the team progressing, sometimes acting as a gateway when decisions need to be reached at a high level of the organization.

Stage 5: Adjourning

When the project approaches completion, team members will need to transition out of the project and back to their functional groups, or other projects. The team leader should ensure that there is enough time to review the project, and capture best practices and lessons learned. The team leader is responsible for addressing concerns of the members as the project nears completion.

It is clear through the description of this process, that the effectiveness of the team is largely dependent upon a number of key characteristics--stemming specifically from the team members and the team leader. The team members need to be good at collaborating, focused on problem solving and reaching goals. The team members need to have the skills to do the tasks, with the sensitivity--both politically and emotionally--to resolve conflicts in order to push past the storming stage. On the other hand, an effective team needs a good project leader; one that can identify and manage conflicts before they escalate. Ultimately, the project leader is a business generalist, with mature emotional skills to deal with others in a tenacious, yet politically sensitive manner. The performance of a team is largely dependant upon the project leader's ability to deliver an environment of a high performing team, and move the team along the phases into the high performing Stage 4.

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**10.4 "The Five Stages of Project Team Development" -** *Article*

*Author(s):* Project-Management.com

https://project-management.com/the-five-stages-of-project-team-development/

The article delivers a great, in depth example of a team, with specific goals, moving along the "five stages of project team development" (Forming, Storming, Norming, Performing, and Adjourning). The example shows how the team overcomes conflicts to exit the "Storming" stage, which is imperative to developing a high performing project team.

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## TOPIC 11: Defining & Understanding the Process Including Process Flow Diagramming

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**11.1 "How to Define Processes for Your Team (and Actually Get Things Done)" -** *Article*
*Author(s):* Kat Boogaard
https://www.wrike.com/blog/define-processes-for-your-team/

The Baldridge Glossary explains that, "The term 'work processes' refers to your most important internal value creation processes. They are the processes that involve the majority of your organization's workforce and produce customer, stakeholder, and stockholder value." In short, the standard ways that important things get done.

There are a few steps involved in identifying your current work process:

1. Enlist your team - This step involves going to each member of the work process and finding out what exactly their roles are, and more importantly, who and where they get information and directions from. It is important to get a detailed understanding of the work process, not just a broad overview of how the process flows. For example, Will Bachman, Co-Founder of Umbrex, says, "Start with a known business process such as, 'We collect money from our customers and then we pay bills,' Then ask the person who collects money, 'Walk me through your portion of the process, step by step.' As soon as the person mentions some piece of information that they get from someone else ask, 'How do you get that information? Who do you get that from?'" Then you can approach the person that was mentioned and ask the same questions, building a chain all the way back to the sales person--the person at the start of the chain.
2. Build a Flow Chart - Use the information you collected in the first step to build a visual representation of the process. This will help guide you when you try to make improvements later on, so literally draw out your process. The purpose is to gain a better understanding of not only the process, but the people, inputs, controls, and outputs; it's important to keep this in mind when forming your visual, to ensure the diagram is actually useful when you finish piecing it all together.
3. Pinpoint Concerns - The goal is not to just see how things flow, but to identify how the flow can be improved. With the information from the first two steps, identifying areas for improvement becomes much easier. At this point, it's important to document those challenges you find, so that you are sure to address them when building the new process.

After identifying your current work process, building a better one can be much easier. The steps involved in this are as follows:

1. Ask Questions - Go back to your team members and ask about their difficulties, ask why the roadblocks are occurring, ask what they need to do their jobs better, that they do not already have, ask them what they think would make their jobs easier.
2. Create a New Flow Chart - Start building a new visual of the workflow that addresses all of the concerns highlighted from your research. Be sure to make it understandable (simple), and "design the process as if you were starting a new entity with great resources," says Daniel Feiman, Managing Director of Build it Backwards. This will help you to focus on making a process that will actually improve the work for your team.
3. Move Backwards - "Start with the goal or output of the process and ask, 'In order to achieve this result, what must we do?'" says Michael Clingan, Founder of The

Claymore Group. Repeat this process until you have reached the very beginning of the process, Clingan suggests reviewing and improving your new process in three situations; when something that could or should be happening isn't, when something that shouldn't be happening is, and lastly, when you don't know what's happening.

4. Reduce the Volume - This means reducing the number of steps laid out in your process, for example, putting operating hours on your website instead of developing a process for providing that information over the phone. A good way for reducing the volume is look for sections where you have one piece of the process being handed off between a number of people; it is usually best to have less people involved in completing each task, meaning that you can easily reduce the volume by assigning each person the sequential subtasks involved in the completion of a single activity.

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**11.2 "Tom Wujec: Got a wicked problem? First, tell me how you make toast" -** *Video (9min)*
*Author(s):* TED
https://www.youtube.com/watch?v=_vS_b7cJn2A

Making toast may seem like a very simple task, however, asking people to draw the process step by step can prove the complexities in it. Drawing the process diagram for something so simple clearly illustrates the problems people will run into when producing process flow diagrams, and the applicability of using workflow diagrams for more complex processes.

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## TOPIC 12: Measures of Effectiveness, Efficiency, and Adaptability

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**12.1 "Effectiveness, Efficiency, and Adaptability" -** *Article*
*Author(s):* Tom Coyne
http://www.tomcoyne.org/resources/ThreeKeyPerformanceMetrics.pdf

This article gives an explanation on the importance of the "three keys to performance measurement." That is, "effectiveness, efficiency, and adaptability." Effectiveness measures how aligned your results were to your goals, efficiency measures how many scarce resources you used to get those results, and adaptability measures the change in effectiveness and efficiency for a given level of change in the organization's environment. All environments are subject to change, and one of the most common reasons for organizational failure is the reluctance to acknowledge and adapt to those changes. It is normal, yet dangerous, to apply the same techniques on similar future projects as used on previous ones (especially when past projects were successful); the article suggests that this is not a good approach since the world is full of complex adaptive systems and therefore impossible to fully understand. Thus it is important to stress the need for recognizing the extent of your own uncertainty, or the role that "luck" has played in past successes. The author then advises a "pre-mortem" approach to any future plans made in order to ensure a better contingency plan.

Part of the contingency plan, or ability to be adaptable, is to "hold resources in reserve." This means not putting all of your available resources to work, which also means not being completely efficient. Therefore, part of being resilient is trading off efficiency; having a reserve of resources for unpredictable, uncontrollable, potentially hazardous changes to the environment. This is a tradeoff because the efficiency measurement views unused available resources as waste. This then presents the discussion for how to decide the optimal level of tradeoffs between effectiveness, efficiency, and adaptability. The question of course is, how much do we need to do to survive now, while also saving enough to survive later when the inevitable changes occur?

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**12.2 "Effectiveness, Efficiency, and Adaptability - The Very Human Side of These Business Processes" -** *Blog*
*Author(s):* Deborah Mills
https://debmillswriter.com/?p=5813

The discussion found here focuses on the importance of "effectiveness" over "efficiency." Effectiveness meaning, "doing the right things," versus efficiency, "doing things right." Both are undeniably important, however the author suggests that a primary focus on efficiency--getting the most benefit from the least resources--can result in losing focus on the objective. This leads to adaptability, which is recognized as "what will get us to where we want to go." This means that the adaptability--the measure of change in effectiveness and efficiency for a given level of change in the organization's environment--is the driving factor of the other two measures. The article suggests that a big problem with humans is the failure to recognize the level of uncertainty, randomness, or luck that took place throughout past successes. The reason this is such a problem is because "the causes of yesterday's success are impossible to fully understand, and unlikely to be replicated to the same extent in the future." Meaning that, reproducing the strategies or approaches, will not necessarily reproduce the outcomes.

This is due primarily to the fact that the environment is always changing, and those "luck" factors that you may have benefited from in the past, might not be there to support you now.

Since adaptability is so important, the author outlines a few focus topics. One of the focus topics, "it is possible to turn the ship around...and it takes a whole crew," suggests that adaptability rests on the shoulders of the entire organization. Decentralized and empowered teams, along with trust, transparency, and collaboration in decision making is the key to developing an organizational culture that expects change, and thrives in it. The final discussion is about "what focus yields a win-win in our workplace?" Which stresses the question, "what can we do to enhance our business process--whether we are in management or on the frontlines of our organization?"

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**12.3 "How to Measure Organizational Effectiveness" -** *Article*
*Author(s):* Gary Harpst
https://www.sixdisciplines.com/performance-management/articles/how-to-measure-organizational-effectiveness

This article covers a few tips for setting targets, and how to choose the indicators that will help show whether an organization is effective in relation to its goals. That is, the way to measure the effectiveness of an organization, depends on its strategic plan. It is not enough to say "we want to be the best," this is not a strategy; to first be able to measure the effectiveness we need to know the long-term and short-term targets. This means we need clearly defined goals, we need to answer the following questions about the organization:

- "What will make us different?"
- "What can we be best at?"
- "What do we have a passion for?"

Answering these questions should help to define the target market and the needs the organization will try to fulfill. This narrower focus allows us to assess the organization's position in relation to its goals, which means the company can develop a "change management plan" for how to attain those goals.

The change management plan is the the roadmap for long-term change, and from this plan the organization, with all of its segments, aligns towards this goal; for this reason, the long-term plan makes all the short term plans directed to accomplish the same goals too. With both long-term and short term goals properly defined, the process for measuring effectiveness will be much easier. There are two types of indicators used to measure organizational effectiveness:

1. **Lagging Indicators** - **Confirms** the level of performance; measures the result of past actions (i.e., revenue, inventory turnover, cash on hand, and stock price).
2. **Leading Indicators** - **Predicts** the level of performance; measures actions that will affect future organizational effectiveness. Tailored to a specific role (i.e., leading metrics for a sales team might be opening calls made, pitches presented, and value of deals proposed).

Some measurements fall under both categories; for example, "number of leads" could be a lagging indicator produced as a result of past advertising efforts. This same indicator could be classified as leading too, since the number of leads can help predict future sales volume.

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**12.4 "9 ways to measure a business process" -** *Article*
*Author(s):* Joe

http://www.businessmapping.com/blog/9-ways-to-measure-a-business-process/

This article discusses “what to consider when measuring a process” by first thinking about the fundamental “supplier-input-process-output-customer (SIPOC) business process model.” Meaning that the purpose of the process, within the overall system, has to be determined first. This will better describe the process priorities, which are likely much different in different businesses. The 9 ways to then measure a business process, is by investigating:

1. **Process Effectiveness** - Measures the process performance to specified customer requirements.
2. **Process Efficiency** - Measures the inputs and resources consumed by the process versus established standards.
3. **Supplier Effectiveness** - Measures supplier performance to specific process requirements.
4. **Units-in-Process** - Measures the unit quantities of inputs and outputs between suppliers and customers.
5. **Product Cost** - Measures the total cost to produce and deliver an output, including inputs, processing and resource costs.
6. **Resource Productivity** - Measures the ratio of outputs produced by the process versus resources consumed by the process, including facility, equipment, people, and information technology
7. **Process Cycle Time** - Measures the time required from inputs supply to outputs delivery.
8. **Process Alignment** - Measures the level of match up between customer demand, process outputs and supplier inputs.
9. **Process Compliance** - Measures the extent to which a process adheres to third party standards, such as maturity, ISO, industry, federal, or SOX.

It is important to note, that “every measure should serve a valuable purpose.” Which means each measure should have a specific reason for bettering the performance of the process. The article suggests that most organizations only “measure what is easy and not what is important.” This approach would clearly be wasteful, as the information gathered would likely be unhelpful, and yet, resources would still be allocated to it. Hence, “by broadly assessing the most essential process elements and then aligning performance measures with strategic purpose and intent, the organization leader can drive best in class performance that provides sustainable competitive advantage.”

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## TOPIC 13: Streamlining of Processes (Elimination of Non-Value Added Work/Time)

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**13.1 "Retail is Ready for Robots" -** *Article*
*Author(s):* Sam Korus
https://ark-invest.com/research/retail-robot

This article focuses on the benefits of retail ready robots, and their ability to transform the retail industry. We know the benefits that robots have on the manufacturing industry, and their ability to increase product quality while also reducing production time, costs, and wastes. This article will go into further depth of the roles robots can play as it compares retail stores such as Walmart, Target, and Best Buy to Amazon.

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**13.2 "Automation of Global Agriculture Will Yield Significant Growth" -** *Article*
*Author(s):* David Conway
https://ark-invest.com/research/agricultural-sector-yield-growth

This article compares the efficiencies of agricultural sectors of India, China, and the United States. You will see in the article that automation streamlines the way in which processes are played out and allows for a huge advantage in agricultural yields. 90% of the work force of the United States in 1790 were in the agriculture industry, which has now dropped below 2% due to automation. This ideology can be applied to many other businesses too, where automation can help improve a company's efficiency while also removing possibilities of human error.

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**13.3 "The Steep Cost of Labour Market Friction: $630 Billion" -** *Article*
*Author(s):* Sam Korus
https://ark-invest.com/research/labor-market-friction

In this article we will see the possible downsides of automation and although it has the ability to streamline processes and increase productivity potential, it completely alters the hiring process and increases employee turnover. Major costs are acquired when people are fired and new people are trained and hired. You will see the costs associated with employee turnover as well as the new costs to train employees to adapt to new automated processes. Automation strips people of their jobs, but it also creates potential new jobs. Although there are costs associated with switching towards a more automated process, this isn't to say that these cost can't be made back in productivity potential.

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## TOPIC 14: Error-Proofing

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### 14.1 "A Toothpaste Factory Had a Problem" - *Article*

*Author(s):* Cliff Williams
https://reliabilityweb.com/articles/entry/A_Toothpaste_Factory_Had_a_Problem

The following is a post by Cliff Williams, the Corporate Maintenance Manager for ERCO Worldwide, a Canadian-based specialty chemical producer. The post is a story about a toothpaste factory that had a problem with shipping out empty boxes. The rest of the story shows the importance of recognizing that the closest to the problems, are usually the ones who have the best suggestions for solutions. Cliff then goes a step further and adds onto this commonly told story. By focusing on some bigger issues, and an upstream approach to solving the problem, Cliff shows the importance of error-proofing a business process.

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### 14.2 "Mistake Proofing" - *Article*

*Author(s):* Nancy R. Tague
http://asq.org/learn-about-quality/process-analysis-tools/overview/mistake-proofing.html

This article summarises a mistake proofing method, and provides an applied example.

In Japanese, poka-yoke, is the process of making errors impossible to occur, or makes an error that occurs extremely obvious, immediately. Accomplished by using automated devices or methods that prevent errors.

So when should mistake-proofing be used? You should use mistake-proofing when human error can cause defects to occur, when a minor error early in a process causes major problems later in the process, and when consequences of an error are expensive or dangerous.

The mistake-proofing procedure can be understood through the following steps:

1. Using a flowchart, review each step while thinking about where human errors are likely to occur.
2. Work back through the process to find the source for each potential error found.
3. Come up with ways you could make it impossible for those errors to happen. This could be through eliminating the step, replacing the step with an error-proof one, or even making the correct action more easy than the error.
4. If you can't make it impossible, consider ways to make the error detected, and how to minimize the effects of the error.
5. Choose the best method or device for eliminating errors for each step. Test it, then implement it.

To minimize the error, and eliminate it completely, consider the inspection method, setting function, and regulatory function. The inspection method can be done a number of ways, that is, you could have workers inspect their own work immediately after doing it, you could have the worker in the next step inspect the work before starting his or her own work, you could also have the conditions be inspected before the work step even occurs--preventing the process from continuing until conditions are right. The setting functions are methods for inspecting errors in a product attribute, or process parameter; for example, the physical or

contact method checks physical characteristics such as diameter or temperature, often using sensors. The regulatory functions are signals that alert the workers that an error has occurred.

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**14.3 "Toyota Production System -5S, Just in Time, Kaisen" -** *Video*
*Author(s):* Will Garate
https://www.youtube.com/watch?v=kce2L23yLcw

This video provides an overview of the Toyota Production System, Just-in-time manufacturing method, and the notion of Kaisen.

At 3:30 the video introduces the second pillar of the Toyota Production System (TPS), "Jidoka;" this is the process of "making abnormalities visible." Every worker is empowered to stop the process when they detect a problem, and to find a solution immediately. The step in the process that is facing a difficulty is made visible on the factory floor, for everyone to see. Team members are encouraged to look deeper and find the source to the problems, known as "Genchi Gentbusu," and to solve the root of the problem to ensure production quality.

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**14.4 "Fishbone Diagram" -** *Article*
*Author(s):* MoreStream.com
https://www.moresteam.com/toolbox/fishbone-diagram.cfm

As seen in the examples above, a problem needs to be fixed at the root; meaning you need to know where on the process you need to implement changes in order to fix those problems. To help you find where problems are coming from, you can use fishbone diagrams, also known as "Cause and Effect" diagrams, and "Ishikawa" diagrams--named after Dr. Kaoru Ishikawa, the developer of the fishbone diagram. The benefits of using the fishbone diagram to identify root causes, are their ease of use, their ability to give good visual linkages of a problem, and it helps prioritize further analysis and corrective actions.

The fishbone approach is best used in a group setting. To get started, you first write out the effect, or the problem to be solved. Connected to that you write down the causes, either categorized by function, or by process sequence. For example, if our problem is "Missed Free-Throws" we would write that on one side as the effect; potential causes would be the shooter, the ball, the form (of shooting), the weather, and the hoop and backboard. Now we have some causes, but that is not good enough, we need to get to the bottom of this, so now we start trying to identify the root causes.

To identify the specific root cause of each cause identified, you can brainstorm with a group, and/or collect data from check sheets (or other sources). A really simple way to find the root causes is to ask "why" at least 5 times, as described by the "5-why" approach. As new root causes are found, and more depth is discovered, they are added to the fishbone diagram. So in our basketball example, we said one of the causes was the shooter; if we ask "why" we can get a number of ideas. For starters, the shooter can be affected by concentration, and motivation; some might say the shooter is affected by his/her conditioning and consistency, but you shouldn't stop there. Ask "why" again, because conditioning and consistency of the shooter is caused by the skill level of the shooter, which is caused by the training. You might even go as far as saying training is affected by coaching, and number of practices, which is a cause of what team or club the shooter part of. The root cause analysis

will continue into more and more depth until the root, the very primary core causes have been identified. It is then important to develop an understanding of, and quantify the relationship between, the Primary Root Causes and the Effect.

If a deeper level of analysis is desired, quantifying correlation and causation can be done using regression analysis, and design experiments. After determining the primary contributors, add that information to your chart. If we determine that the root cause is the rim size, for example, because the shooter is at the carnival with a modified rim. Then we can save the shooter the hassle of changing the basketball team he/she plays for, and provide a suggestion for corrective action that would actually help the shooter make free-throws. In this example,the suggestion might be to stop taking shots, in order to avoid the losses and frustration caused by an unfair shooting chance.

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## TOPIC 15: Cycle or Throughput Time Reduction

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### 15.1 "Process Cycle Time Reduction" - *Article*

*Author(s):* Bjorn Andersen
http://asq.org/quality-progress/1999/07/one-good-idea/process-cycle-time-reduction.html

This article discusses the importance, as well as some methods, of reducing "cycle time." Cycle time is determined by the "bottleneck" of the process, that is, the part of the process that is slowest to be completed. Since a reduced cycle time means faster production, it has clear value adding benefits. For example, if a company needs to create 1000 units of product, a faster cycle time means less cost of labour--since workers would accomplish the tasks in less time; more importantly, a lower cycle time would also mean higher customer satisfaction, since deliverables would be ready sooner. There are multiple ways to reduce cycle time, some might seem better suited for certain processes than others, however it can be helpful to consider the methods in combination with each other.

The article outlines the following methods for reducing cycle time:

- Perform activities in parallel - Rather than having each step in sequence, one after another, pair activities to occur at the same time--overlapping activities.
- Change the sequence of activities - Make the process more directive, with less back-and-forth actions.
- Reduce interruptions - Interruptions are issues that cause delays and increase cycle time for a critical process. Instead, take these delays and (if they cannot be eliminated) move them away from the critical business process, and let others handle it.
- Improve timing - By reducing time intervals between activities, the cycle time can improve drastically.

The article finishes with a short case study in streamlining. The case study incorporates the methods to reduce cycle times described above, for an electronics manufacturer.

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### 15.2 "Behind the Scenes: An Inside Look at Amazon's Futuristic Distribution System" - *Article*

*Author(s): Melissa Burns*
http://innovationexcellence.com/blog/2017/04/11/behind-the-scenes-an-inside-look-at-amazons-futuristic-distribution-system/

This article will talk about Amazon's use of robotics in their fulfillment centers and how this can increase workflow efficiency. In this day and age, waiting even the slightest bit can be considered an inconvenience. With such high customer demand and an increasingly competitive industry, having a distribution centre that can produce orders quickly and efficiently, is a major competitive advantage.

Amazon has mastered the use of human-machine collaboration in its fulfillment centers. Although there are still some that are primarily ran by humans, the more sophisticated locations have robots and humans working alongside one another. The well known Kiva robots have been distinct players is Amazon's distribution process. So much so that in 2012, the retailer bought the company. In order to maintain their competitive over other competitors, these Kiva robots are Amazon exclusives and will not be sold to other

companies. Robots can save humans several miles of walking that they would normally do each day, increasing speed and efficiency or workers. For now robots will work alongside humans, but as technology improves the potential of these robots will expand.

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**15.3 "Tesla's Core Business Is Bleeding Cash And The Model 3 Is Not Speeding To The Rescue" -** *Article*
*Author(s): Jim Collins*
https://www.forbes.com/sites/jimcollins/2017/10/03/teslas-core-business-is-bleeding-cash-and-the-model-3-is-not-speeding-to-the-rescue/#366061d14695
**"Tesla's Production Problems Are The Company's Achilles' Heel" -** *Article*
*Author(s): Jim Collins*
https://www.forbes.com/sites/jimcollins/2017/11/30/teslas-production-problems-are-the-companys-achilles-heel/#38c7ef271a2f

These two articles are about the issues arising with Tesla's production problems. With initial planning to create 1,500 units of the Model 3, Tesla came out short with only 260 units. The benefit to taking the time in perfecting a product is eliminating the need for recalls and the expenses that come along with them. In many cases, automakers focus on line speed, and producing as many cars as they can in a short amount of time. When the line needs to be stopped for noted issues, profits go to waste. However, this process of stopping the line is essential to avoid the need to do re-work.

"The company has shown no evidence that it can product luxury cars at a proper linespeed and not it is attempting to build a mass-market vehicle, the Model 3". Cash burn is the biggest issue Tesla faces, and the slow process of producing these Model 3 vehicles is not benefitting the cause. In general, automakers are able to generate plentiful amounts of cash during times of economic expansion by increasing their production levels and then maintaining them as long as the economy allows. Unfortunately, this is not happening at Tesla.

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## TOPIC 16: Process Innovation/Redesign or Reengineering

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**16.1 "Debunking Disruptive Innovation - Why Disruptive Innovation is NOT a Strategy" -** *Article*
*Author(s):* Soren Kaplan
http://innovationexcellence.com/blog/2015/01/24/debunking-disruptive-innovation-why-disruptive-innovation-is-not-a-strategy/

This article takes on a unique spin of a term we know all too well, disruptive innovation. Soren Kaplan goes on to argue that disruptive innovation is not a strategy, it is just a term we have latched onto to describe past innovative events. One of the greatest disruptive innovators, Steve Jobs, said the same thing. These innovative disruptions don't start out with the intentions of revolutionizing their industry. If you look back at Apple's iTunes Music Store, it was created because "we thought it would be great to be able to buy music electronically, not because we had plans to redefine the music industry." Same goes for Google, it was created to make the process of library searches more efficient. Unrealistic expectations appear when we set sights on creating disruptive innovation.

**"If You Only Swing for the Fences, You Won't Score on Singles, Doubles or Triples"**
It is also important to note that when your one and only focus is to hit home runs you miss the opportunity to score smaller goals. There is an example of Kodak in this article, and how they took a single swing for the fences and attempted to enter a billion dollar industry, clearly that failed. Fujifilm, another company that you will see in the article, was in the same position as Kodak. What Fujifilm did differently was it steered away from disruptive innovation, and it still stands today. The article is filled with additional great examples of companies that have "disrupted" industries, without the classic "disruptive innovation strategy".

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**16.2 "Here's How to Master The ABCs Of Innovation" -** *Article*
*Author(s):* Chunka Mui
https://www.forbes.com/sites/chunkamui/2017/01/10/abcs-of-innovation/#3d574ea642e4

With technology changing so rapidly, Fortune 500 CEOs are declaring this their "single biggest challenge". Additionally, surveys identify technological disruptions to be the highest risks organizations face. As the title may have given away, the main take away from this article is the importance of mastering the ABCs of innovation. Douglas Engelbart's model describes "A" processes as the core activities of the organization. This would include things such as product development, distribution, marketing, manufacturing, sales, and so on. "B" processes are used to improve the functionality of the "A" process. A "B" process would work towards making "A" processes more affordable, profitable, without sacrificing quality (BPR, continuous improvement, Six Sigma). Lastly, a "C" process would focus on improving those "B" processes, and most commonly disregarded. The article will dive deeper into the importance of having the fundamentals of those "C" processes and also show how the lack of a "C" process contributed to Kodak's ultimate downfall.

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**16.3 "How Kodak Failed" -** *Article*
*Author(s):* Chunka Mui
https://www.forbes.com/sites/chunkamui/2012/01/18/how-kodak-failed/#15fa382f6f27

This article looks into Kodak’s failure to recognize a technological disruption, and how an error in judgement resulted in its the company's downfall. Kodak engineer, Steve Sasson, invented the digital camera in 1975. When showing his invention to corporate their response, in his words, were “But it was filmless photography, so management’s reaction was ‘that’s cute - but don’t tell anyone about it.’”. This ignorance shown by management continued on for decades and the topic of digital photography didn’t spark any attention. It wasn’t until Sony introduced its very first electronic camera that Kodak began to look into the issue and at this point they had 10 years to prepare for this transition from film to digital. Even within this time frame Kodak continued to put minimal effort into catching up with this more recent innovation, despite the fact they understood it could potentially replace the company. This article also references other readings (not free) you may be interested in exploring, one being a book called “Devil’s Advocate Group” written by the authors colleague, Vince Barabba, who was a former executive at Kodak.