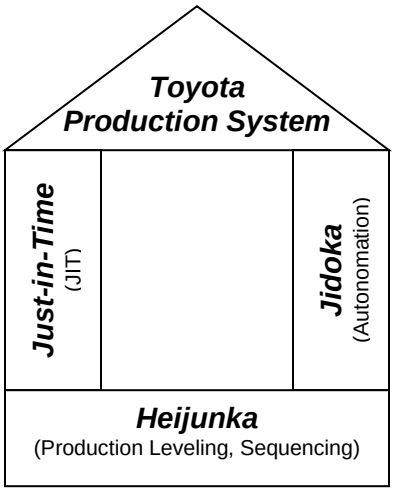

Note: This study guide was created to highlight some of the main points of the book in an abbreviated format. The best way to understand the book is to read it in full – it is a short book and is a quick read.

Introduction	
The Toyota Production System	➢ "All we are doing is looking at a time line from the moment the customer gives us an order to the point when we collect the cash. And we are reducing that time line by removing the non-value added wastes" (Taiichi Ohno) ➢ The Toyota Production System evolved out of need. The Japanese marketplace required production of *small quantities - many varieties - in conditions of low demand* ▪ Unlike the U.S., Japan could not simply build and sell everything it produced. ▪ Firms today face the same type of market Japan faced in the 1950s – they can no longer base production on desktop publishing and push product onto markets. ➢ The Toyota System is not just a production system – it is a management system adapted to today's global markets and high-level computerized information systems. ▪ Toyota seeks to make a factory or organization operate like the human body
Taiichi Ohno and Henry Ford	➢ Henry Ford mined iron ore on a Monday and used it to produce a car on Thursday afternoon. Ford focused on flow and elimination of waste --- Ohno just updated Ford. ➢ All kinds of waste occur when we try to produce in large, homogeneous quantities (batch production). It is much more economical to make each item one at a time. ▪ The former is what the Ford System became - the later is the Toyota System.
Push v. Pull Production	➢ ***Push Production*** – planned production quantity is determined by demand predictions and inventory on hand – production is produced in sequence starting from step one. ➢ ***Pull Production*** – the final process withdraws the required quantities for the preceding process at the time and in the quantity needed
Chapter 1 – Starting from a Need	
Toyota in Postwar Japan	➢ Postwar Japan was the catalyst for Toyota's need for the Toyota Production System ▪ After the war, Japanese productivity lagged behind U.S. 1-to-9 ▪ The Toyota President said "Catch up with America in three years" to survive ➢ Taiichi Ohno reasoned that U.S. workers could not physically produce more than Japanese, and concluded that it must be waste (muda) that caused the gap ▪ The auto industry required Toyota to learn how to eliminate waste while producing small numbers of many types of products ➢ Toyota's successes in eliminating waste using the Toyota system went unnoticed ▪ Other industries experienced higher demand ("if you build it, you can sell it") and could adopt the U.S. style of mass production to be competitive ▪ Mass producers cut costs by producing large volumes of a few types of products

Oil Crisis of 1973	➢ The 1973 Oil Crisis was the catalyst for interest in the Toyota Production System ▪ Mass production had worked for many companies when demand was high, but the Oil crisis created a period of higher costs and lower demand ▪ Toyota performed much better than mass producers during this period
Pillars of the Toyota Production System	➢ The basis of the Toyota system is the elimination of waste. The two pillars needed to the support the system are: (Note: also see the diagram on the preceding page) ▪ ***Just-in-Time*** – parts arrive at the right time and in the amount needed ▪ ***Jidoka*** – "autonomation," or automation with human intelligence ➢ Using a baseball analogy, Jidoka is similar to the skill of an individual player, and Just-in-Time corresponds to the teamwork involved in winning a game.
Just-in-Time	➢ Just-in-time production means parts arrive at the right time and in the amount needed ▪ This is easier said than done - Toyota's auto industry had of thousands of parts ➢ To implement just-in-time system, parts must be pulled from the preceding processes when needed instead of being pushed based on a production schedule ➢ ***Kanban*** (sign board) was Ohno's common sense solution to the challenge of delivering parts at the quantity and time needed ▪ A kanban serves as a signal for an earlier process when to produce
Jidoka	➢ Jidoka means "autonomation," or automation with human intelligence ▪ Automated machines can allow thousands of defects to be made very quickly ▪ Autonomation means machines operate autonomously but and stop immediately if problems occur - can distinguish between normal and abnormal conditions ➢ Stopping the machine when there is trouble forces awareness and improvement ▪ Workers themselves should stop production if an abnormality exists
History of the Toyota Production System	➢ Prior to 1943, Taiichi Ohno worked in Textiles and not Automobiles – this gave him an outside perspective from an industry where autonomation already worked ➢ To catch up to U.S. productivity, Ohno wanted one operator to care for many machines, and work with several different types of machines at the same time ▪ Labor unions prevented this in the U.S. and forced planned mass (batch) production since each operator was a specialist in a different type of machine ▪ Mass production allows defects to move forward in a process undetected - waste ➢ Ohno experimented with flow production and one operator for many machines.
Production Leveling	➢ One part of Heijunka, level loading, prevents end of the month rushes in production ➢ Production goals are planned to the minute using a TAKT time analysis so that production is spread evenly over the month ▪ Problems are identified and solved as they occur instead passing to next process
Chapter 2 – Evolution of the Toyota Production System	
Ask Why 5 Times	➢ Asking why 5 times helps to get to the root cause of an issue
Waste Analysis	➢ Present Capacity = Work + Waste ➢ The seven forms of waste (3 x People, 3 x Quantity, 1 x Quality) ▪ Processing ▪ Motion ▪ Moving Things ▪ Defects/Inspection ▪ Waiting ▪ Inventory ▪ Overproduction ➢ Two points about waste elimination… ▪ It only makes sense when tied to cost reduction – utilize manpower efficiently ▪ Look at the efficiency starting with the operator, groups, and then plants
Standard Work Sheets	➢ Standard Work Sheets provide information on how a task is to be performed ▪ Effectively combine materials, workers, and machines ▪ They are displayed prominently at each work station and provide visual control ➢ Workers will not prepare Standard Work Sheets until convinced of their importance

Sports Analogies	➢ Sports analogies help people understand the need for the Toyota System ▪ 8 people row a boat – some are stronger, but they must row together to succeed ▪ Volleyball teams of six people are more efficient than teams of nine ▪ In baseball, players have positions but must play outside of strict boundaries and back each other up to be successful ▪ Production work should be passed like a baton from one worker to another ➢ Important points in common between sports and work are **practice** and **training**
Supermarket	➢ Supermarkets are where customers get what is needed, at the time & in the qty needed ➢ Earlier processes in a production line are a kind of 'store' ▪ Later processes (customers) go to earlier processes (supermarkets) to get needed parts at the time and in the quantity needed
Kanban	➢ Kanban is a tool for realizing just-in-time – it serves as a signal to do something ▪ Typically a piece of paper containing pick-up, transfer, & production information ➢ Kanban is a tool that if used improperly can cause a variety of problems ➢ The rules of Kanban 1. Later process picks up items indicated by the Kanban at the earlier process 2. Earlier process makes items in the quantity and sequence indicated by the kanban 3. No items are made or transported without a kanban 4. Always attach a kanban to the goods 5. Defective products are not sent on to the subsequent process 6. Reducing the kanban increases their sensitivity
First Rule of Kanban Later process picks up from earlier process	➢ Many obstacles to implementing the first rule of kanban: ▪ Workers have psychological resistance to not producing as much as possible ▪ Set-ups must be done more often to make product as withdrawn ▪ If the earlier process withdraws a large quantity of one item, shortages occur ➢ These issues were solved one by one over 20 years ▪ A kanban system requires flow, level production, and standard work
Second Rule of Kanban Earlier process makes only what was taken	➢ Obstacles ▪ Demand must be "level loaded" throughout the production period to prevent spikes that make it difficult for the earlier to maintain production ▪ Work must also be properly "sequenced" to prevent demand spikes; not batches – Example: Daily production of 10,000 cars; 5000 sedans, 2500 hardtops, and 2500 wagons. The sequence should be sedan, hardtop, sedan, wagon, etc…. ➢ Building only what is used makes the Toyota Production System more flexible to meet customer needs than the American Style of Mass Production
Defects and Kanban	➢ For kanban to work, production must be defect free. ▪ If defects occur, the line must stop and the problem must be resolved ➢ If work is not defect free, it is difficult to ensure just-in-time production
Types of Kanban	➢ Kanbans are commonly a piece of paper contained in a rectangular vinyl envelop ➢ Kanbans are even more effective when combined with carts of limited capacity ➢ Moving production lines are another way to limit capacity and control production
Chapter 3 – Further Development	
The Autonomic Nervous System in a Business Organization	➢ A business organization is like the human body; the body has nerves that react to a problem without a deliberate thought ▪ Many automatic decisions are needed in a production plant; i.e. when to stop production, what production sequence to follow, whether overtime is needed ➢ A business should have the reflexes that can respond immediately to small changes in the plan without having to go to the brain ▪ The larger the business, the better the reflexes it needs

Computers	➢ The computer is a great invention, but humans control computers (not vice versa) ➢ Computers cause problems in production by forecasting demand ▪ Excess inventory is made if production orders distributed to all departments and earlier process to build ahead of the later process' demand ➢ Computers make it difficult to react to changes in demand and modify production
Toyota-Style Info Systems	➢ Toyota makes computer generated production schedules, but they are sent only to the end of the production line ▪ The kanban acts as a production order for earlier processes ➢ Kanbans adjust to small changes in demand autonomously w/o going to the brain for a decision
True Economy; Excess Capacity; Productivity	➢ The purpose of process improvement is cost reduction ▪ Purchasing a $500 device to replace one worker makes sense, but purchasing it when the worker could be replaced by changing the work sequence is wasteful ➢ When excess capacity exists, the only cost incurred are variable production expenses ➢ Manpower reduction means raising the ratio of value added work ➢ There are two ways to increase productivity; 1) increase qty, 2) decrease workers
Waste	➢ Waste refers to all elements of production that only increase cost w/o adding value ▪ Motion: A worker "moving" is not necessarily working ▪ Overproduction: Working ahead of schedule is waste…it hides waiting ➢ Secondary waste is when excess people, equipment & inventory are used to create unnecessary work (non-value added work) ➢ The greatest waste of all is excess inventory, since it creates the need for unnecessary transportation and warehousing
Tact Time	➢ Required Production / Available Time – or the time needed to make on product ➢ Operating Rate – the amount of time a machine operates out ➢ Operable Rate – the amount of time that a machine can operate when needed
Chapter 4 – Genealogy of the Toyota Production System	
Toyota Beginnings	➢ Toyota was originally in the textile industry – Toyoda Spinning & Weaving ➢ Toyota Motor Company was formed in 1933 to produce passenger cars in Japan ➢ Global competition had traditionally forced Toyoda Spinning & Weaving to take a global view - this mindset continued in Toyota Motor Company
Toyoda Sakichi	➢ Toyoda Sakichi founded ***Toyoda Spinning & Weaving*** ➢ Toyoda Sakichi popularized ***Jidoka*** (autonomation) ▪ Sakichi's invention stopped a fabric loom when one of the many threads broke ➢ Sakichi wanted to harness Japanese intellect to catch up with Europe / America ▪ Provided 1M Yen to his son to research and establish the auto industry
Toyoda Kiichirodo	➢ Toyoda Kiichirodo, son of Toyoda Sakichi, founded the ***Toyota Motor Company*** ▪ In addition to laying the foundation for the automobile industry, Toyoda Kiichiro wanted to develop a distinctly Japanese production technique ➢ Toyoda Kiichirodo popularized ***Just-in-Time***
Toyota Motor Company	➢ Toyotaism are principles that Toyoda Kiichirodo placed on the automobile industry ▪ Provide cars for the general public ▪ Perfect the passenger car industry ▪ Make reasonably priced cars ▪ Recognize the importance of sales in manufacturing ▪ Establish the basic material industry ➢ Although the auto industry was protected by the Japanese government, Kiichirodo did not depend on this protection completely; he ensured Toyota was competitive

Chapter 5 – The True Intention of the Ford System	
Henry Ford (1863 – 1947)	➢ Without dispute, Henry Ford created the automobile production system ➢ The Ford system symbolizes mass production and sales in America today ➢ Both the Ford and Toyota Production Systems are based on work flow ▪ Ford holds inventory to ensure flow, Toyota seeks to eliminate inventory
Set-Ups & Lot Sizes	➢ Set-ups were regarded as an element that reduced efficiency and increased costs ➢ The Ford system reduced costs with large lot sizes between set-ups ▪ Ford uses a planned production schedule to manage work ➢ The Toyota system looks at small lot sizes and quick set-ups ▪ Toyota uses kanban to manage work – earlier process go to later to pick up parts ▪ Toyota works to totally eliminate overproduction and inventory ➢ Time will tell which system is better, but the Toyota system is perhaps better suited to periods of low growth
Henry Ford & Waste	➢ "We do not have to bother about…resources. What we do have to bother about is the waste of human labor." ▪ "…when a chunk of coal has been mined and set down in Detroit, it becomes a thing of importance, because then it represents a certain amount of the labour of men used in its mining and transportation. If we waste that bit of coal…then we waste the time and energy of men"
Standard Work	➢ The elements to consider in standard work are the worker, machine, and materials ➢ Ford noted that standards should be set slowly to prevent setting the wrong standard ➢ Standards should not be forced down from above, but set by workers themselves ▪ Allows local know how and ensures progress s and creativity ➢ "The eventuality of industry is not a standardized, automatic world in which people will not need brains. The eventuality is a world in which people will have a chance to use their brains, for they will not be occupied from early morning until late at night with the business of gaining a livelihood."
Ford's Intentions	➢ Ohno believed that mass production was not Ford's true intention ▪ Ford wanted work flow to extend along the entire value stream, from raw material to final production…but he only established flow in the final production line ▪ Market conditions requiring the manufacture of multiple models of automobiles and standardized pricing caused the mass production system to become entrenched
Chapter 6 – Surviving the Low-Growth Period	
Automation	➢ Automated machines often were unable to make judgments or stop by themselves ▪ Workers had to tend the machines, so automation was "labor-saving" it was not "worker-saving" and nothing was saved through reduced manpower ▪ For effective automation, machines must detect the occurrence of abnormalities
Low Growth Productivity	➢ "There must be hundreds of people around the world who can improve productivity and efficiency by increasing production quantity…but few people in the world can raise productivity when production quantities decrease."