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THE AKSHAYA PATRA FOUNDATION:
Process Analysis and Improvements in the Service Factory that Feeds a Million Kids

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"We currently provide meals to over one million school children. Now, our goal is to provide meals to five million children by 2020. We have grown our operations very fast and have been successful. However, we need to introspect to decide if continuing with the same methodologies and kitchen models will help us achieve this goal as we expand further and go to new locations. We also need to see how we can optimize our current operations to feed more children from our existing locations." This quote, from Ajay Parikh, Executive Director of Strategy for The Akshaya Patra Foundation (TAPF), was given to a team of eager MBA students from the UCLA Anderson School of Management to give them an overview of TAPF's vision, strategy and operations.

He went on to say that "maintaining food quality across all our kitchens is our primary objective. One metric we use to check quality is the time window from the time it's cooked to the time it is consumed by children. Currently this cook-to-consume-time is six hours at most of our kitchens and it is our objective is to bring it down as much as possible." TAPF regularly receives invitations to open new kitchens from state governments, but Ajay worried whether TAPF would be able to optimize current operations enough to keep up with these demands for their services.

INDIA

Surrounded by oceans on three sides, India is the seventh largest country in the world in terms of geographical area, but second largest in terms of population. Therefore, while India occupies only 2.4% of the world's landmass, it supports over 15% of its population. Approximately 40% (around 480 million) of this massive population is under 18, which is significantly greater than the entire population of the United States.

After gaining its independence from the British in 1947, India adopted socialist economic policies leading to very slow, but stable growth of between 2% to 3% per year (also known as Hindu rate of growth). However since its liberalization in 1991, India's economic growth has increased, and averaged around 7% per year from 2000 to 2010.

Even after such a robust growth rate in recent years, 42% of India's population (~500 million) is still below the international poverty line of $1.25 per day.[1] With an adult literacy rate below 70%, the Indian population faces serious challenges on several fronts including nutrition, education and health.

MALNUTRITION AND ITS IMPACT IN INDIA

According to UNICEF, malnutrition is more common in India than in Sub-Saharan Africa. In fact, 1 in 3 of the world's malnourished children lives in India. One report suggests that child malnutrition is prevalent in 7% of children under the age of 5 in China and 28% in sub-Saharan African compared to 43% prevalence rate in India.[2] Children with infections are

[1] http://en.wikipedia.org/wiki/Poverty_in_India
[2] http://en.wikipedia.org/wiki/Malnutrition_in_India

more susceptible to malnutrition; while at the same time, malnutrition impairs the immune function leaving children more susceptible to infection. Therefore, malnutrition is a vicious cycle for any country's health system. It is responsible for 22% of India's burden of disease. So, it's not surprising that the World Health Organization cites malnutrition as the greatest single threat to the world's public health.[2]

Malnutrition not only affects physical appearance and energy level, but also directly affects many aspects of children's mental function, growth and development. In turn, this has adverse effects on children's ability to learn and process information and grow into adults who are productive and contributing members of society. Although 108 million children attend primary school in India (making the country's education system the second largest in the world after China), rampant poverty forces approximately 45 million children (including 13.5 million between the ages of 6 and 13) to pursue menial work over attending school in order to generate additional income for their families.

MID-DAY MEAL PROGRAMS IN INDIA

The mid-day meal scheme is the popular name for school meal programs in India. It provides a free lunch to schoolchildren on all working days. The key objectives of the program are: (1) protecting children from classroom hunger; (2) increasing school enrolment and attendance; (3) improved socialization among children belonging to all castes; (4) addressing malnutrition and (5) social empowerment by providing employment to women.

When the program began, the government of India provided grains free of cost and the states in turn would provide for the costs of other ingredients, salaries and infrastructure. However, most state governments were unwilling to commit their limited budgetary resources, and ended up solely passing on the grains provided by the government to parents. This system was called 'dry rations.' On November 28, 2001, the Supreme Court of India passed the following mandate to be implemented in June 2002: "*Cooked mid-day meal (MDM) is to be provided in all government and government-aided primary schools in all the states.*" This made it mandatory that state governments provide cooked meals instead of just dry rations.

Following the order, the state of Karnataka in southern India decided to provide cooked meals by inviting private sector participation in the program. One such venture was with TAPF in the capital city of Bangalore. The foundation gets a corpus from the state government, but meets a major share of its costs with donations from private corporations and individuals in the city. The program is managed using an ultra-modern centralized kitchen, which is run by a joint public and private partnership. Food is delivered to schools in sealed, heat-retaining containers just before lunch break each day. The program contains one of the best menus of school meal programs in India.

THE AKSHAYA PATRA FOUNDATION

The Akshaya Patra Foundation (TAPF) was started by the International Society of Krishna Consciousness (ISKCON)[3] in Bangalore to address the issues of child education and hunger. TAPF recognizes that only through education can children get better paying jobs and break the cycle of poverty. In alignment with this goal, TAPF incentivizes children to attend school by providing them with a nutritious meal on school premises, catered to the cultural taste preferences of that particular region.

In 2001, TAPF initiated a pilot project to feed 1,500 children daily at 5 schools in Bangalore. Based on the success of this project, TAPF's goal was to provide hygienic and nutritious meals daily to one million children by 2010. Through an extremely cost-effective and high-quality process, they achieved and then surpassed this goal ahead of schedule. As of the first quarter of 2010, TAPF feeds 1.1 million children daily (from Monday to Saturday) in 17 cities across 7 states in India becoming the largest, non-governmental, mid-day meal program in the world. Of the 17 locations, there are 14 centralized kitchens, 2 decentralized kitchens and 1 hybrid kitchen. Most of the kitchens adopt the same format with culture-driven food differences across locations dictating technological differences. The organization now aspires to feed five million children by 2020 with the belief that feeding and educating an underprivileged child is not an act of charity, but a social responsibility.

The foundation strives to ensure that it can serve the needs of school children in the most cost-efficient manner and believes in reducing costs and maintaining quality through the use of

[3] http://news.iskcon.org/

advanced technologies, effective management and utilization of a strong human capital base. To support its operations, the foundation receives support from the government, but also receives supplementary support from private donations. TAPF distinguishes itself from other mid-day meal programs around the world by the flexibility and creativity with which its feeding programs have been conceived and executed. Children are provided with one of the best menus in school meal programs in India, a menu that includes spiced lentils, rice, vegetables and even a small amount of yogurt most days. The kitchens set the menu for each day of the week in advance so that they can plan procurement appropriately.

DIFFERENT KITCHEN MODELS

TAPF has three types of kitchen operations: centralized, decentralized and hybrid. In centralized kitchens (see Exhibit 1), food is prepared in large quantities at a high volume food processing assembly line (up to 200,000 meals per day). The cooked meals are then packed in large vessels of different sizes at a different assembly line and then loaded in mini-trucks and transported to schools in radius of up to 40 miles from the kitchen. The volunteers or teachers at each school help serve the cooked food from large vessels to individual students' lunch plates.

Decentralized kitchens (see Exhibit 1) are used when prepared food cannot be sent to remote locations every day due to long distances and poor roads. In these cases, raw materials are distributed to schools located in villages every few days depending upon how far the village is from a raw materials warehouse. Cooking actually takes place at kitchens attached to each school where female workers or volunteers (usually two to three) prepare the food each day and serve the students.

In hybrid kitchens, the food is cooked and distributed to nearby schools. Raw materials are also stored for schools where cooked food cannot be sent daily. For these schools, raw materials are sent to their kitchens each week. The rest of the process of preparation and serving the meals is similar to that of a decentralized kitchen.

The processes and challenges at each kitchen model are quite different and vary according to their distance relative to warehouses and schools. Since the food menu is customized

according to the location to match local taste, the procurement and production processes differ accordingly.

A CENTRALIZED KITCHEN OPERATION: BANGALORE

Out of all the kitchen models, the centralized model is the most technology-intensive model. The automated kitchen facility in Bangalore is an excellent example of how automation has improved efficiency. However due to the advanced technology and equipment used in these facilities, the production process is more complicated and more vulnerable to variability. Also, TAPF's centralized kitchens are ISO certified (a recognized process and operations quality standard). As part of this certification, all steps in the production process are documented in detail and workers are trained to follow these steps. In addition, TAPF management has instated its own policies to ensure high employee satisfaction, low turnover and suitable training for all of its workers.

Located on the outskirts of Bangalore, TAPF operates a three-level centralized kitchen with a cooking capacity of 105,000 meals per day. Each floor is assigned one operations supervisor. To ensure timely information flows, each floor supervisor uses a walkie-talkie to communicate with the other supervisors. Adjacent to the kitchen building are the master storage silos for rice and lentils (also known as daal in Hindi). TAPF uses rice received from the federal government as well as the rice bought with corporate or individual donations. The silos can hold up to 275 tons of rice and lentils.

From afternoon to evening each day, grains from the master silos are cleaned through an automated cleaning machine that removes impurities such as small stones, wood and sand particles. The cleaned grains are then transferred to storage silos located on the roof of the kitchen building by motorized buckets. Daily supplies are stored in one of three silos: one ten-ton silo for government rice, one seven-ton silo for rice donated by corporations and one three-ton silo for lentils. In addition, vegetables are cleaned and cut on the third floor (usually by manually-operated cutting machines). These cut vegetables are kept in cold storage for use next morning. The vegetable cutting section employs 14 people. Due to the large number of meals that are produced, setting up the production process starts as early as 3am each day.

Production of rice and lentil starts at 4am and must end by 10am to ensure on-time delivery of meals to the schools.

THE RICE COOKING PROCESS

The rice cooking process begins when rice from the storage silos are sent through pipes, which run from the roof to the third floor, and received in standard vessels that can hold 25kg (see Exhibit 2, Picture 1). To ensure accuracy, each vessel is weighed prior to each time rice is loaded into it. Four such vessels (or 100 kg of rice) are then put on a trolley and moved near the next set of pipes, which travel to the second floor where cooking takes place. Rice from these four vessels is distributed among three large tubs where they are again washed and soaked in clean water. The processing time for this cleaning is 15 minutes and is done in parallel with a worker assigned to each of the three tubs. Since the skills needed are relative simple, these workers are paid about $0.75/hr.

On the second floor, each of the pipes from the third floor opens above a big cauldron that is used to cook rice (or lentils). Along with each of these pipes, another pipe runs through an overhead water tank to just above the cauldron. One quarter of each cauldron is then filled with water, which is then boiled. The first time the cauldron is used each day, it takes 50 minutes to boil the water. For each subsequent cycle, it only takes around 20 minutes. After the water is boiled, the second floor supervisor communicates to the third floor supervisor that the cauldron is ready to receive the soaked rice for cooking. At this time, workers on the third floor start pouring soaked rice from the cleaning tubs (see Exhibit 2, Picture 2) into the pipe that leads to the second floor cauldrons (see Exhibit 2, Picture 3).

There are eight cauldrons for cooking rice on the second floor. Each standard cauldron can hold three tubs of cleaned rice; therefore, a batch of 100kg of rice is cooked in each cauldron. Once these tubs are loaded, an appropriate amount of salt is added. A thermometer is kept in each rice cauldron and the rice is cooked until the temperature is between 90°C to 98°C. Generally, it takes another 20 minutes to reach this temperature after the rice is added to the boiling water; however, cooking time varies depending on the quality of the rice. The workers have observed that lower quality rice takes longer to cook, which eventually increases total production time. Unfortunately, there is no effective method for determining the quality

of the rice before cooking. While quality of the rice does affect cook time, small increases in the quantity of rice does not; therefore, some extra rice can be added to the cauldrons as needed when demand is higher than expected. Typically, the kitchen needs to cook about 24 cauldrons of rice each day to meet current demand.

Fifteen employees work on the second floor. Of these, one is the head cook responsible for rice, and one is the head cook for lentils. Since these jobs on this floor require a higher level of skill, wages range from $1 to $2.5 per hour, with the highest levels reserved for the two head cooks. The supervisor of the rice cooking process signals when the rice is ready. It is then unloaded onto a trolley (see Exhibit 2, Picture 4). It takes an average of 10 minutes to unload the cooked rice onto the trolley; however, there is a limited number of trolleys available. If all of them are in use, then the cooked rice is left in the cauldron until a trolley becomes available. Once a trolley is loaded, workers take it to the opening of a wide and sloping channel that runs from the second floor to the first floor, where packaging is done. This is accomplished without any significant processing time. When the workers on the first floor are ready to load the rice into steel vessels, the first floor supervisor communicates to second the floor supervisor to send the cooked rice down the channel (see Exhibit 2, Picture 5).

On the first floor, the cooked rice is loaded directly into the steel vessels (see Exhibit 2, Picture 6). TAPF is very committed to the overall safety of their product; therefore, they sanitize any vessel before use for either production or packaging. Since the requirements of the schools vary due to student size and attendance, the steel vessels are of different sizes to ensure that the correct quantity of food is sent to the school and waste is minimized. In addition to different vessel sizes (see Exhibit 2, Picture 7), there are also five possible fill levels, which determine the quantity of rice to be loaded into each vessel. This provides additional flexibility to adjust supply to match demand of each school. For example, if a school only needs the equivalent of two and a half vessels of rice, then two full vessels and one half-full vessel are sent. Different kitchens have different fill levels, which varies between three and five levels. However, these varying fill levels tend to create confusion among new or insufficiently trained workers. This in turn may lead to food waste. Typically, less literate, jobless or farm workers from nearby villages are employed for loading and packaging, as TAPF believes that these jobs require comparatively less training. Stickers are placed on each vessel indicating the fill level (see Exhibit, Picture 8). The vessels are then put on a conveyor belt that takes them to a

loading area where they are loaded directly onto the appropriate transportation (aee Exhibit, Picture 9). Approximately 15 to 20 people work on first floor who are mainly responsible for loading, packaging and cleaning. Their wages are around $1 per hour. It takes 15 minutes per batch to package the rice along with the lentils. The highest level of employee turnover occurs in packaging. Management believes that the main reason behind this turnover is because workers (mainly male workers) do not like tasks such as packaging, loading and cleaning. In addition, several skilled workers from the cooking stages generally leave to join nearby restaurants or hotels that are able to pay higher wages. The steps of the rice cooking process are outlined in Exhibit 3.

THE LENTIL COOKING PROCESS

The lentil cooking process is somewhat similar to the rice production process. However, due to the nature of this food, it takes longer to cook lentils than rice. In order to cook a comparable quantity of lentils per hour, TAPF has installed larger cauldrons. There are 6 such cauldrons with a capacity of 240kg each and about 5 "buffer" cauldrons each with a capacity of 100kg. The buffer cauldrons are used to cope with unexpected demand surges or when the main cauldrons are unavailable due to maintenance. In addition, the rice and lentil cauldrons can be used interchangeably if needed; however, this requires significant cleaning times and consequently is not done frequently. These cauldrons represent the most significant capital investment of the process. The kitchen needs to cook about 15 large cauldrons of lentils each day to meet current demand. Unlike rice, lentil grains are not washed on the third floor. The pipe carrying them runs from the roof silos to the second floor where workers manually fill large vessels. Once the vessels (which are similar to the rice cleaning tubs used on third floor) are filled with lentils, they are taken on trolleys to the cauldrons and manually offloaded into them.

The lentil-cooking process also involves adding spices to lentil grains (and sometimes vegetables depending upon the menu of the day). So, as the lentils are being cooked, a few workers on the third floor work on preparing the spices (called masala in Hindi). Industrial grinders are used to grind the raw spices (such as chilies, turmeric, pepper, etc.) into powder, which is then mixed with salt and water. Next, this mixture is sautéed in oil and to form a liquid that will eventually be added to the lentil cauldrons on the second floor. This liquid is

then stored in steel vessels. It takes around 15 minutes to prepare this mixture for a single 240kg batch of lentil grains.

The lentil cooking process begins when each cauldron is filled halfway with water and is brought to a boil. It takes 20 minutes to boil the water to 90°C. The lentils are then loaded into the cauldron and an adequate amount of salt is added. Once the lentils are cooked for 75% of the required time, the supervisor communicates to the third floor supervisor that a particular cauldron is ready to receive the liquid spice mixture. This is then added from a pipe running from third floor. It takes 100 minutes to in total to cook the lentils after they are added to the boiling water.[4] If the menu requires vegetables, then cut vegetables are added to the lentils in the cauldron and it takes another 30 minutes to finish cooking. For example, vegetables are added to the lentils almost every day in Bangalore.

The process of unloading the lentils onto a trolley and transporting it down to the first floor for packaging is similar to that of rice unloading and packaging. The only difference is that instead of wide channels, TAPF uses a pipe to transport the cooked lentils from the second floor to the first floor. Unloading the lentils takes 18 minutes per batch, while packaging them with rice takes 15 minutes per batch. There is a tap on each pipe on the first floor that allows the workers to control outflows and reduce waste (see Exhibit 2, Picture 10). Similar to rice packaging, different fill levels are also used for lentil packaging. The steps in the lentil cooking process are shown in Exhibit 4.

TRANSPORTATION FROM THE CENTRALIZED KITCHEN

TAPF uses owned or rented vehicles to deliver meals to the schools attached to the centralized kitchens. At the Bangalore kitchen, they need an average of 21 vehicles for deliveries each day. These vehicles are not uniform in size (ranging from a small pickup truck to a large van) because they were added to the fleet as demand increased. Even some of the rented vehicles vary as they are rented from local businesses. Each vehicle is assigned to run a specific route predefined by a delivery supervisor.

[4] When backup cauldrons are used, the cooking time is usually reduced by 20 to 30 minutes compared to when regular cauldrons are used.

The number of schools on each route varies depending on the number of students at each school. Consequently, some routes cover more schools than others because these schools have fewer students and unloading time depends only on the number of students. However, the number of schools on each route directly affects transport time because of the times it takes for trucks to stop and park at each school. By definition, these setup times are fixed and do not depend upon the number of students at each school.

TAPF has installed metal racks on their vehicles. These racks have a grid design with each level holding a different size vessel (see Exhibit 2, Picture 11). This arrangement keeps the vessels within the square cube when the vehicle is in transit. This in turn reduces food waste from vessel slippage or overflow. The rack also helps TAPF in loading and unloading vessels according to the order of schools on a specific route. For example, vessels for schools at the end of the route are loaded first on to the vehicle in a last–in-first-out (LIFO) sequence. This arrangement reduces the time it takes to unload at a particular school as vessels for that school are now easily available at the front for unloading.

The rented vehicles are usually of various makes and sizes. In addition, there are no racks installed on these vehicles because they are used for other purposes by their owners outside the TAPF delivery hours (see Exhibit 2, Picture 12). Without racks, there is a greater chance of spillage, as well as the inconvenience of not being able to load the vessels in the LIFO sequence. A rented vehicle costs about $20 per day. Purchasing a new vehicle, which has a lifetime of seven years, costs $18,000 to $22,000. This high initial capital investment encourages TAPF to rent vehicles instead of buying them.

Typically, lunch time at the schools is between 11:30am to 1:00pm. So to maintain a reasonable cook-to-consume-time, deliveries start as early as 8:30am for schools that are more than 90 minutes away from the kitchen. Deliveries to schools that are less than 30 minutes away from the kitchen start later, with the last truck leaving around 10:30am. It takes between 30 to 120 minutes to deliver meals to a school depending upon the specific route and distance to the school. At times, the vehicles are kept half-empty to maintain the appropriate cook-to-consume-time for schools that are furthest away on a route. Another factor that affects the cook-to-consume-time is the size of the vehicle. A larger vehicle placed on a route that mainly includes two-lane, narrow roads leads to longer time in transit. All routes are

divided into four zones and each zone has a designated supervisor. All zone supervisors report to the distribution manager. Each vehicle carries at least one driver and two helpers to assist with unloading vessels at each school.

After reaching the school, the helpers unload the vessels and place them in the eating area or kitchen of the school. For record keeping purposes, a school administrator signs a form to acknowledge receipt of the meals. This administrator also provides a forecast of the meals required the next day. This is based on factors such as local holidays, picnic days or absence due to illness. At the Bangalore kitchen, there is an additional person known as the road supervisor who collects these orders from the school, while at other kitchens the driver collects this information.

Some schools transfer the food from TAPF vessels into their own vessels. In these cases, the vehicle either waits to collect the emptied vessels or picks them up after making all of their deliveries for the day. Some schools have an identical set of vessels to that of TAPF. In this case, the helpers unload the vessels at the school and load the cleaned vessels from the previous day back into the vehicle. This way, the vehicle does not have to wait until the food is transferred or come back, thus reducing overall delivery times. About half of the 600 schools covered by TAPF Bangalore have a second set of identical vessels in the school's kitchen. One set of vessels, which can hold food for up to 80 students, costs approximately $150 and lasts about 7 to 10 years.

All vehicles arrive back at the kitchen no later than 3:00pm each day. The zone supervisor aggregates the orders from the school and passes them on to the distribution manager who converts this into specific order quantities for each product on the menu. Based on this estimate, the evening shift supervisor requisitions the raw materials needed (such as grains, rice, vegetables and spices) from the store department in time for the start of the next day's production cycle.

A DECENTRALIZED KITCHEN OPERATION: BARAN

Since all schools (especially in rural areas) are not accessible through roads or within feasible driving range of a centralized kitchen, TAPF developed a decentralized kitchen model

to service these schools. TAPF currently has two decentralized kitchen operations: one in the West Indian state of Rajasthan and the other in the East Indian state of Orissa. The reason TAPF labeled these kitchens as decentralized is because the actual production of meals occurs at each school's kitchen instead of one of their larger centralized kitchens, while the supplies for these kitchens come from a centralized warehouse.

The Rajasthan decentralized operation is located in the town of Baran. Here, raw materials such as grains and spices are stored at a warehouse in Baran (see Exhibit 2, Picture 13). The warehouse serves about 120 schools within a 65-mile radius. Typically, a rural school has less than 100 students and is the only school in the village. These schools are further divided into clusters of 15 to 30 schools. The number of schools in a cluster depends on distance between two farthest schools — the greater the distance, the fewer schools in the cluster. Each cluster is assigned a supervisor who visits these schools on a motor bike at least once a week. Since the cluster supervisor cannot visit every school every day, there are field supervisors who visit a smaller number of schools (ranging from six to seven) within a cluster every day on a bicycle provided by TAPF.

At the Baran decentralized operation, there are 12 field supervisors and 5 cluster supervisors. There are five more helpers who are permanently staffed at the warehouse. All of them are managed by the decentralized kitchen operations supervisor. Apart from these employees, there are two additional people (including a driver) responsible for delivering the raw materials to the schools. The decentralized operations kitchen supervisor reports to the kitchen supervisor at the Jaipur centralized kitchen, located about 250 miles from Baran. The Baran warehouse has limited storage capacity and receives spices and grains such as rice and whole wheat from the bigger warehouse at Jaipur's centralized kitchen. The Baran warehouse employs 10 to 12 contract workers to manually clean the grains, creating local employment opportunities. They also have contracts with a couple of local flour mills that convert the wheat into flour on short notice.

Each school has a separate kitchen area, which ranges in size. At some schools, the kitchen is covered by shade or a roof; whereas, the covered area at some locations is so small that cooking must take place outside the kitchen area under either open sunlight or under a temporary shade (see Exhibit 2, Picture 14). TAPF provides trunks to every school to store the

grains, spices and cooking oil that are delivered every few days (see Exhibit 2, Picture 15). Apart from the trunk, TAPF also provides a cooking stove, pans and other cooking vessels, which generally cost around $150. Typically, there are three cooks at each location, with one of them designated as the head cook. Cooks are trained for about three days on techniques of hygienic cooking and on TAPF-approved cooking methods. In addition, many of these cooks have never used a gas-fueled cooking stove. However, due to the higher initial cost of buying stoves and training costs, TAPF provides wood-fueled cooking stoves (see Exhibit 2, Picture 14). However, wood-fueled stoves take longer to set up each day and contribute to larger levels of air pollution.

TAPF does not deliver fresh vegetables for the meals or the wood required for the stoves. Instead, the head cook is responsible for buying fresh vegetables and wood from local vendors using their own money. The head cook gets reimbursed once every two weeks by the warehouse supervisor based on comparable rates for vegetables and wood at local markets. The head cook also keeps track of the grains, spices and oil used and informs the field supervisor 2 to 3 days before the school might run out of any of these supplies. The field supervisor in turn informs the warehouse supervisor who arranges for raw materials to be delivered to the school using a pickup truck (see Exhibit 2, Picture 16). Therefore, the raw materials delivery schedule is typically based on the head cook's notification rather than a preset delivery schedule.

Depending on the number of students at the school, the cooking window varies from school to school, but typically starts at 9:00am in order to get the meals prepared by noon. Like the schools seved by a centralized kitchen, the students are expected to bring their own plates. Since the plates are not uniform (or at times the students forget to bring plates), the amount of food served can vary (see Exhibit 2, Picture 17).

The decentralized model utilizes less technology since it produces lower volumes and is located predominantly in rural areas. Consequently, it is difficult to achieve the same levels of efficiency and quality seen in the centralized kitchens. The relatively high human interaction required in the decentralized model also increases the importance of proper hygiene as direct handling of food becomes more prevalent. Decentralized kitchens pose special challenges to TAPF, as there is no direct control over the actual cooking process and procurement at these

locations. They believe that, as a direct consequence, the average meal cost at a decentralized kitchen is more than that of centralized kitchen. An approximate breakdown of the difference in costs at the various locations is provided in Exhibit 5. However, TAPF also recognizes that there are many rural students who need meals and cannot be serviced by building a centralized kitchen. The management at TAPF believes that better procurement strategies and operational procedures could help them reduce overall food costs even at these decentralized operations.

A HYBRID KITCHEN OPERATION: VRINDAVAN

In the town of Vrindavan in the North Indian state of Uttar Pradesh, a centralized kitchen was built to cook around 55,000 per day in order to serve the surrounding areas in a 50-mile radius. However, as the popularity of TAPF grew, administrators of nearby villages wanted TAPF to serve schools in their villages and demand at the kitchen quickly rose to 150,000 meals per day serving 1,400 schools. Since the original kitchen was not built to cook so many meals, it became operationally and financially inefficient to continue expanding the centralized operation. So, TAPF had to think of a way to serve all of the rural schools near Vrindavan without losing their bargaining power with their suppliers and the savings from automated methodologies at its centralized kitchen. The administration thought that this could be achieved by leveraging the logistic system for the centralized kitchen to manage the raw material procurement, storage and transportation process for the decentralized kitchens. This led to the development of the hybrid kitchen operation. Thus, this operation is similar to the decentralized model because cooking is conducted at the school kitchen. However, the hybrid operation differs in the procurement, storage and distribution and of raw materials.

In the hybrid operation, a centralized warehouse maintains deliveries to the school kitchen on a preset weekly schedule. Unlike the purely decentralized kitchen, the deliveries also include flour and fresh vegetables, such as potatoes, and other nonperishable items that can last between three and five days. This takes the burden of procurement away from head cooks at schools as well as allowing TAPF to get lower prices from their suppliers by leveraging and strengthening their bargaining position. In addition, centralized procurement reduces variability in the quality of materials and in the delivery schedule. Another key difference with the decentralized kitchen operation is that most of kitchens in the hybrid operations use gas stoves instead of wood stoves (see Exhibit 2, Picture 18). The Vrindavan operation places significant emphasis on training, so the cooks at these kitchens receive up to 15 days of

training including learning how to effectively use gas stoves. The Vrindavan kitchen also employs local MBA interns to help them analyze and improve logistics at these rural kitchens.

The hybrid kitchen employs 50 people. There are 21 field supervisors assigned to 1 of 7 cluster supervisors who in turn report to the decentralized kitchen supervisor. Drivers and delivery boys make up to the rest of the team. There are about 13 vehicles for weekly and bi-monthly deliveries. Items such rice, lentils, gas cylinders and spices have a longer shelf life and can be delivered on a bi-monthly basis. At one location, a kitchen attached to a school with more than 100 students is also used to cook food for smaller schools in the vicinity. Local workers then transport the cooked food using bicycles. In this manner, the hybrid kitchen operation covers 106 kitchens, but feeds students from 160 schools.

SETTING UP NEW KITCHENS AND OPTIONS

"Due to the success of our operations across India, we keep receiving requests from state governments to start new kitchens. Deciding whether to start a centralized kitchen anywhere involves evaluating many parameters," said Usha Gujaral, executive secretary of TAPF and coordinator on several new initiatives. TAPF takes up to two months to assess if the government recommended town or city is suitable for operations. This assessment involves understanding the required capacity of the new kitchen in terms of meals per day, the procurement of raw materials for the new location, the logistical challenges that they might face and local culture. If the outcome of the initial evaluation is positive, then TAPF decides to set up a temporary kitchen to actually "test the waters."

It takes up to six months to set up a temporary kitchen once TAPF picks a location. Usually the local government allots a vacant government building for use as a temporary kitchen. It takes up to six months to convert this premise into a useable kitchen. If TAPF decides to stay at this location, it takes about 18 months to build a new kitchen with a capacity of 200,000 meals per day and usually costs between $650,000 and $1,000,000. The state government typically does not pay for machinery or other capital expenses; however at times, it might subsidize the cost of land. Therefore, TAPF depends on corporate and other private donations to accumulate enough capital to start building a new centralized kitchen.

The significant capital investments associated with creating a new, large centralized kitchen slows down or prevents TAPF from opening many new kitchens. They have learned to better leverage installed resources at a big kitchen to reach the maximum number of schools within the vicinity. However , not all locations are able to reach the students in need within acceptable cook-to-consume-times after considering rising transportation costs and poor roads. Consequently, a section of TAPF management believes that they should build more smaller-capacity kitchens, which would be a mini-centralized kitchen with the capacity to cook 50,000 meals per day in order to provide more flexibility and reduce capital and transportation costs. However, there are others in management who are also skeptical of this idea. "Large centralized kitchens allow TAPF to leverage its huge buying power in the market and bargain with suppliers to get a significantly lower rate than the going market rate. This saving in turn justifies the cost of installing machines such as the destoner, rice cleaning and flour making machines (see Exhibit 2, Pictures 19, 20 and 21). We have observed that we don't utilize these machines to their full capacity even for big centralized kitchens so installing them in smaller kitchens doesn't make sense," said Ajay Parikh. "What will probably be interesting is to see if a hub-and-spoke model can work for us. I mean we can establish a big centralized kitchen with a capacity of over 100,000 meals per day where we can install all these machines. This kitchen acts as a hub with responsibility of procurement and is surrounded by smaller mini-centralized kitchens (with around 50,000 meals per day capacity) acting as a spoke (see Exhibit 6). However the pros and cons of this model need to be evaluated before it can be rolled out across the organization."

FUTURE PLANS AND ALTERNATIVES

TAPF has built a highly successful non-profit operation. However, they now face the serious challenge of growing rapidly to meet the ever increasing demand for their services without compromising the quality of their meals. With a year-end strategic board meeting scheduled in few days, Ajay pondered which options TAPF should opt for as it expands. Should it establish larger centralized kitchens or should they go for smaller, mini-centralized kitchens? Is the hub-and-spoke concept the model of the future? Which model would best reach students in non-urban areas? He also knew there would be continued interest in how TAPF could improve current operations, especially by increasing capacity in term of meals served per day while maintaining or improving cook-to-consume-times and quality. These issues are even more daunting as any subsequent decision they make and will have far

reaching consequences on TAPF's mission and could affect the lives of millions of children in India.

SUGGESTED QUESTIONS

1. Draw a process flow diagram to describe the production process at the centralized kitchen.

2. Calculate the capacity and utilization for each of stage of this diagram and identify the bottleneck of the centralized kitchen operations.

3. Should this stage be the bottleneck if this is a well-designed process? If not, what stage should be the bottleneck and why?

4. Calculate the production lead time for the last rice and lentil batches in this centralized process. What does this tell you?

5. Where should Ajay Parikh add capacity at each process to accommodate the expected 20% increase in demand for meals at the centralized kitchens while still keeping the overall production time under 6 hours? How should these increases in capacity be accomplished?

6. What would be your recommendations to improve the distribution system of the centralized kitchens?

7. Develop a detailed list of recommendations to improve procurement, production, distribution and human resources at the decentralized kitchen in Baran.

8. Provide a list of benefits of a hub-and-spoke model versus building bigger centralized kitchens (with capacity of 150,000 meals per day) or a series of smaller centralized kitchens (with a capacity of less than 50,000 meals per day).

EXHIBIT 1: CENTRALIZED AND DECENTRALIZED MODELS

Centralized Model

- 105,000 meals per kitchen (maximum capacity)
- 12 locations
- Cook to Consume Time: 6 to 7 hrs
- Urban Areas

Prepare the food

Warehouse

Deliver cooked food to nearby schools

Feed the children

Decentralized Model

- Raw Materials (sent from centralized kitchen's warehouse)
- 3 locations
- Cook to Consume Time: 90 mins

Raw Material Storage

Deliver Raw Materials

Local women cook the food

EXHIBIT 2: PICTURES OF THE FOOD MAKING PROCESS

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

Picture 6

Picture 7

Picture 8

Picture 9

Picture 10

Picture 11

Picture 12

Picture 13

Picture 14

Picture 15

Picture 16

Picture 17

Picture 18

Picture 19

Picture 20

Picture 21

EXHIBIT 3: THE RICE COOKING PROCESS

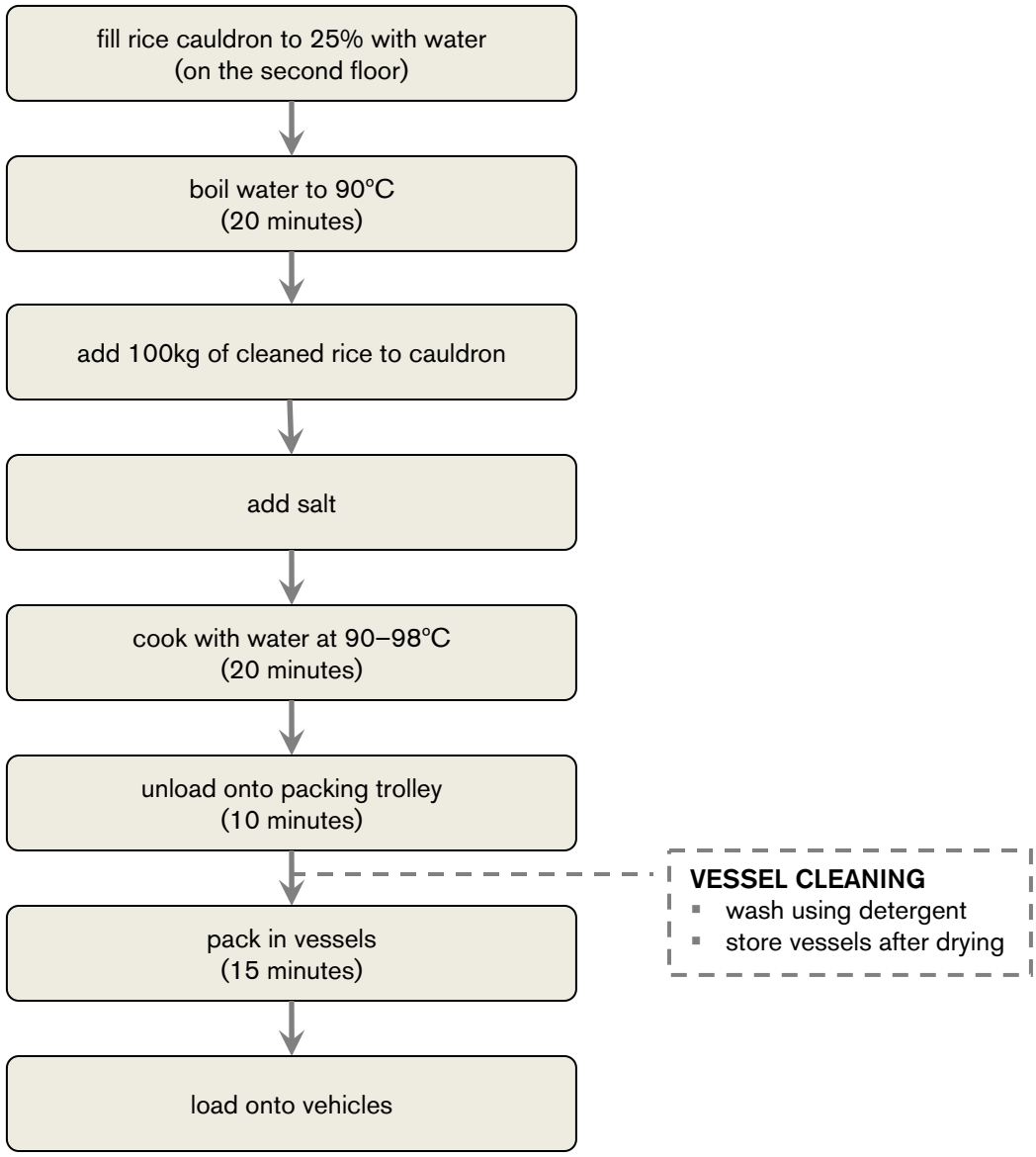

EXHIBIT 4: THE LENTIL (DAAL) COOKING PROCESS

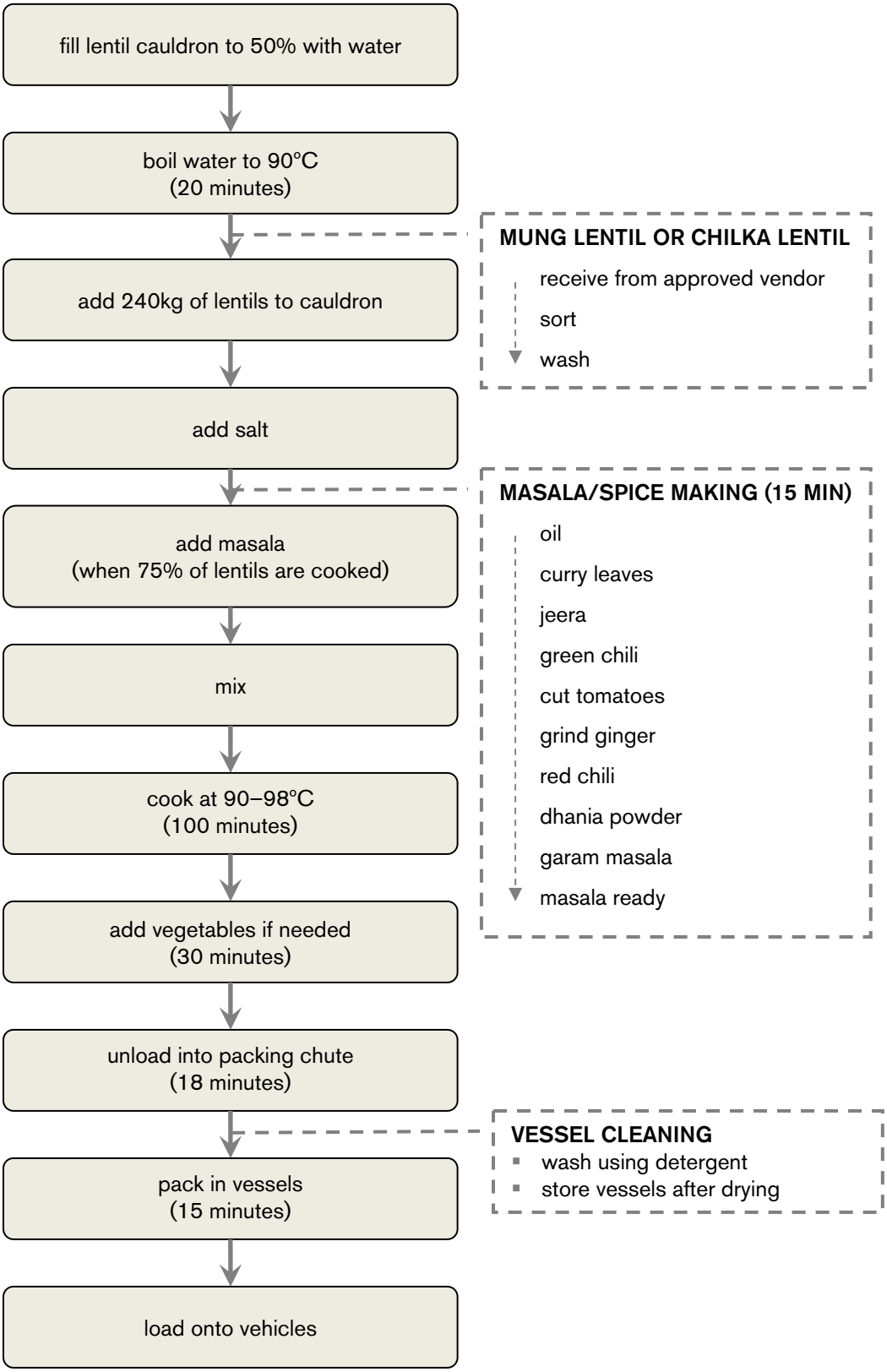

EXHIBIT 5: COST BREAKDOWN OF A MEAL AT VARIOUS TAPF LOCATIONS

Particulars	Bangalore	Hubli	Bellary	Mangalore	Mysore	Puri	Hyderabad	Vizag	South India	Vrindavan	Jaipur	Baran	Nathdwara	Ahmedabad	Bhilai	New Delhi	North India	All India
Direct Costs	4.24	3.96	3.16	5.11	3.83	3.65	3.74	4.90	3.95	3.93	3.66	5.13	3.70	3.81	4.08	8.81	3.89	3.93
Cost of Food	3.70	3.29	2.57	4.38	3.58	2.90	3.07	3.75	3.35	3.00	2.86	4.55	2.75	3.25	3.55	6.72	3.09	3.26
Distribution Expenses	0.54	0.67	0.59	0.72	0.25	0.75	0.67	1.16	0.60	0.93	0.81	0.57	0.95	0.56	0.52	2.09	0.80	0.67
Indirect Costs	0.33	0.39	0.58	0.39	0.71	0.69	1.03	5.04	0.84	0.57	0.56	0.52	0.44	0.66	1.11	1.57	0.62	0.76
Administration Expenses	0.10	0.15	0.34	0.15	0.18	0.42	0.67	4.27	0.38	0.32	0.24	0.28	0.21	0.39	0.87	1.34	0.34	0.36
Publicity and Promotion Expenses	0.23	0.24	0.23	0.25	0.53	0.26	0.36	0.77	0.46	0.24	0.32	0.24	0.23	0.28	0.23	0.23	0.28	0.39
Notional Costs	0.71	0.63	1.47	0.60	1.24	0.63	0.97	0.92	0.82	0.44	0.83	0.05	0.16	0.74	1.38	0.65	0.68	0.77
Depreciation	0.71	0.63	1.47	0.60	1.24	0.63	0.97	0.92	0.82	0.44	0.83	0.05	0.16	0.74	1.38	0.65	0.68	0.77
Cost Per Meal	5.28	4.98	5.20	6.10	5.77	4.97	5.75	10.86	5.61	4.93	5.05	5.69	4.29	5.21	6.57	11.03	5.19	5.45
Less: Subsidy Recd	2.63	2.71	2.53	2.53	2.50	3.04	3.63	2.35	2.71	3.26	2.97	2.65	2.74	2.01	3.41	-	2.88	2.77
Cost borne by TAPF	2.65	2.26	2.67	3.57	3.28	1.93	2.12	8.50	2.90	1.67	2.08	3.04	1.56	3.20	3.15	11.03	2.30	2.68

Puri, Baran and Vrindavan are decentralized kitchens, rest are centralized ones. South India and North India columns represent average cost per meal in those geographical areas

EXHIBIT 6: HUB AND SPOKE MODEL