



## **National Centre for Cold-chain Development**

## Issue 12 | February 2015







### The CEO's Desk

In February 2015, Mr. Ashish Bahuguna, Secretary of Department of Agriculture and Cooperation and President of NCCD's Governing Council retired. At the same time Mr. Anup Kumar Thakur (Secretary, DAHDF) also retired. We wish them farewell and NCCD requests them for their continued mentorship on agrilogistics and cold-chain development. Their valuable support and contributions to this sector, as Fellows of NCCD is sought.

Shri Siraj Hussain is now Secretary (A&C) and will be guiding us as President of NCCD's Governing Council and Chairman of our Executive Committee. His past keen interest in cold-chain is well known and members will see continued focus and innovation in this sector.

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#### **OP-ED INVITATION:**

Readers are invited to articulate their ideas, concepts & comments. NCCD Annual Journal will be published in 2015 & scholarly studies are also invited.

In February, a focus talk on how agri-logistics plays a key in role rural development and future agribusiness livelihood was given to Probationers from the 2014 batch of LBS National Academy of Administration.

This month, from 24 to 27 February 2015, the Indian Society of Heating, Refrigerating & Air Conditioning Engineers (commonly known as ISHRAE) organised its sixteenth edition of ACREX in Bangalore. ACREX is the mega event of engineers, gathering participation from more than two dozen countries and is attended by the 'who's-who' of the engineering world. This event was the first time that special focus was given to cold-chain at an ACREX gathering. Recognising the importance of cold-chain, an exclusive pavilion on cold-chain technologies, as well a full day debate symposium was organised at ACREX 2015. ISHRAE is a category-R member of NCCD, and henceforth plans to continue giving particular attention to matter of food logistics. While air conditioning has remained the core focus area for industry engineers, given its large existing market demand, the attention from the engineering fraternity on food security is gaining momentum and most welcomed.

The Union Budget has proposed a key exemption for cold-chain, an important move that supports not merely infrastructure creation but the service itself. The proposed exemption has direct impact on the profitability in back-end operations in the cold-chain, a focus area. Though the service of cold storage and transportation of agricultural produce was already exempt from service tax, the back end operations at cold-chain facilities built by service providers, were liable to levy of service tax. These services are closely linked to cultivators and are key to having effective cold-chains for fresh fruits and vegetables.

-Pawanexh Kohli







Product or Industry

Value Chain System

Production

Harvest

Aggregate

#### Value chain & Strategy

Cold-chain development is commonly debated over round table discussions, mostly by business researchers and prospective financiers. The non-inclusion of practical domain experts, can tend to make these discussions academic and the result is a wizardry of value chain numbers. The reason is largely because there are a mere handful of strategic experts who have partaken across the wide range of functions that make the cold chain - it truly is a niche sector! However, the cold-chain is increasingly taking importance as heart and centre of food security in the future, and such discussions need to move from the rhetoric into the realm of reality. There is real need to include operative considerations – after all, even the original round table of King Arthur had a functional head with fighting knights on board, and only one Merlin the wizard.

The approach to cold-chain needs orienting towards a supply chain business, one where the chain of custody is key to its success. In this type of business, it is not about earning off the infrastructure, but off the product or service that the firm undertakes, with infrastructure pieces being an enabling tool.

The business perspective needs to start with a broad vision – seen as the vision statement of many well thought-out enterprises. The Vision is the future state one resolves to realise, the big picture outcome to aim for! Therefore, the vision is a direction setting statement. To realise that vision, from words into reality, the next move is to narrow down and notify the immediate mission.

The mission statement should ideally state the close term output being targeted. The mission, consequent and in abidance to the overarching vision, could be revised as per dynamic ground realities. As one progresses towards the objective, another mission based action may be required.



An example of a **Vision statement** is, "India the Food Basket of the World", or.. "Produce in India, Feed the World". The conjoined **Mission statement** can be, "To minimise Food Loss by 15%" or.. "To build a modern Pack-house in every Village" or.. "To Build a Food Gateway", or even all three!

To fulfil the mission, a value chain and a value proposal is developed which first requires understanding the enterprise's own resources, both current and those that will need to be developed. This phase is where the process of strategic planning initiated. The most advantageous strategy will not be one to merely fit into the existing value chain system (*if any*), but to intelligently disrupt and/or establish the value chain anew.

Value chain is a concept that should be well understood by planners. There is a chain of activities across a product's source to market cycle, and then there is one which is a series of activities internal to a commercial enterprise. The first is the product value chain, also called the 'value chain system'; the latter is the firm's own 'value chain'. If a business owns the value chain system in entirety, it captures all of the resulting

Indirect / Ma	anagement	1.00			Pre-conditio
HR Technology	Docking	ucs Storing			Transport
Maintenance Inventory Collections	Unloading Deconsolidation Put away Recording	Cooling FEFO / FIFO Monitoring Waste management	Outbound Picking / packing Staging Docking Loading	15	Storage Distribution
Sample chain c the Value Chai	of internal activities – n of a cold store firm		Dispatch	Business Value Chain	Retail



realisation. However, the value chain of a business entity is usually a component of the total value system, being dependent on its capability and expertise. An organisation's value chain reflects its overall business strategy and helps define its value proposal in an evolving manner.

It is obvious that if a firm can capture the entire value system, it can develop to be the most efficient as the chain of custody will be most secure. However, as this is not always the starting case, in the long term, expanding one's value chain to encompass the entire value system is a strategy of progression.

In the course of developing a strategy, an enterprise will not only assess its own resources but also the outsourcing and collaboration in certain activities, so that its value chain fits into the overall value chain system. This exercise will lead to the developing of tactics on various fronts such as finance, infrastructure, operations, marketing, etc. These tactics will incur functional costs and generate revenue, which eventually will delineate their own stake in the overall value chain system.

This individual capture of activities, measured as their value chain, is not a constant and will change with circumstances and competition, and as other capabilities are developed. Linkages with other value chains, which

#### Chain of business

- Chain of transactions.
- Chain of information.
- Chain of operations.
- Chain of processes.
- Chain of policies.
- Chain of people.
- Value chain.

Demographics, Priorities, Technology, Information, Sustainability, Collaboration, Affiliation.

comprise the value chain system of which they are a part, is also key to sustained success. The ability to control external value chains is best exemplified in case of automobile OEM manufacturers and their control on the value chains of associated component suppliers.

The value chain when quantified is a measure of efficiency, is a variable as it is the result of strategic inputs and tactical outputs, and of course, helps define the competitive status and commercial profitability of a firm. Value chains are not to be mistaken as the mission.

A product value chain or value chain system will commonly comprise of collaboration of value chains of multiple commercial businesses. When a model is collaborative across activities, the overall value chain of the commodity is not to be confused with an entity's value chain, as the latter defines its individual value proposal and its viability.

An existing transaction model, like the farm to fork model with price build-up points enroute is not to be mistaken as the value chain. When a commercial model is well defined, existing value chain systems are available to improve upon, and each individual business within the system will have its own space - its own value chain.

Successful programs aim to disrupt existing value chains, to result in innovative processes and new formats. In planning and executing to achieve a business format, many variables will come into play, and hence operative tactics need to be dynamic and in turn feedback information for any strategic course corrections. The final value options, are dependent on multiple variables such as the chains of



activities, processes, policies, and transactions that ensure the mission. This when quantified is always improved upon, through fresh innovation. Simply put, value chains are not operating models but a metric of activities and transactions.

First define a mission, then understand the specific chain of activities required, to complete a mission, then plan how. This means that if, for example, one has decided to run in a three legged race: then on

assessing the resources in hand - two legs only - will define the strategic direction. The strategy would be to find a partner, train and build capacity to compete, so as to achieve an honourable position by the end of three years. The tactics would include financing the running shoes, buying time on athletic tracks, the right diet, scaling participation in preparatory races and maybe even extend to developing a fall back runner. The mission is to win and the value realisation could be more than the winning the race itself. The value chain would be the chain of efforts put into these tasks.

The total achievable relates to initial resource assessment and those that can be developed, strategic planning and execution. The value gained is most when an firm's value chain captures or controls most of the value chain system. Changes in the series of events in the course of moving towards the vision or mission, will reflect concurrently on the value chain status - if stayed transparent.



## National Centre for Cold-chain Development

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#### **BUDGET BOOST**

# The Union Budget 2015-16 exempts key pre-conditioning activities, are necessary for post-harvest handling of fruits & vegetables, from service tax.

NCCD has frequently explained, that to properly utilise and benefit from the cold-chain, the supply chain operator, needs



to prepare the harvested produce for onward travel from farm gate to market. This involves preconditioning procedures (i.e. sorting, grading, washing), retail packaging and labelling, precooling, before undergoing climate controlled storage and transportation and ripening. None of these measures alter the essential characteristics of agricultural produce as no food processing is involved – the farm produce is delivered fresh and whole, from farm to market. These procedures alone make it possible for agricultural produce to be supplied more efficiently, prolong the freshness of produce and help to reduce losses.

Though, under the provisions in India's Finance Act, in regards to service tax (see Section 66D (d) (iii) of Chapter 5 of Finance Act 1994 and Chapter VA of Finance Act 2003), processes carried out at an agricultural farm which do not alter the essential characteristics of agricultural produce but only make it marketable for the primary market fall under the Negative List; elsewhere (Section 65B(5) of the Act), "agricultural produce" is defined to mean any produce of agriculture on which either no further processing is done or such processing is done as is usually done by a cultivator or producer. This narrowed the interpretation so as to apply to these services, only if done on a farm, by the farmer.

Actually these processes, activities that prepare a produce for safe onward trip to market, are carried out at pack-houses operated by cold-chain operators. These pre-conditioning activities are not done at an agricultural farm, as in India most farm holdings are very small, but done at the level of aggregator at pack-house facilities. These activities are part of the supply chain, to improve the transportability of the agricultural produce to market. These activities are key to the primary task of cold-chain, to deliver fresh to markets, as far away as feasible.

The pack-house or cold-chain operators, are entities like agri-entrepreneurs, logistics service providers, cooperatives, FPOs, etc. These operators must obviously undertake backward integration with the cultivators in organizing and facilitating the go-to-market preparatory activities. Yet, since they themselves are not the cultivators of the agricultural produce, the narrow interpretation of tax laws required that this service be subject to tax. This key initial activity in the fresh whole food supply was therefore not benefiting from the real intent of the Negative List provided in the Finance Act. This tended to discourage investment in agricultural supply chain, especially in the much needed back-end or farm gate, still underdeveloped.

With these inputs in mind, the Hon'ble Finance Minister, in his 2015-16 Budget proposed that "Services by way of pre-conditioning, pre-cooling, ripening, waxing, retail packing, labelling of fruits and vegetables which do not change or alter the essential characteristics of the said fruits or vegetables", henceforth be exempted from service tax. This will come into effect from 1-April-2015 (refer notification No. 6/2015-Service Tax). Other logistics services by way of Cold storage and transport of agricultural produce will continue to remain exempt of service tax.

In effect, with the coming into force of this notification, the entire value chain of activities, in case of fresh fruits & vegetables (*pre-conditioning, packing, precooling etc. at pack-houses; reefer transport; cold storage; ripening; distribution*) is exempt from levy of service tax. This translates into an immediate 14% savings to the bottom-line in this trade.

We hope, the development of the much needed pack-houses, as source points of the fresh food cold-chain, will benefit from this exemption. Remember, the farm gate needs to be connected in an uninterrupted fashion to consumers, to ensure that healthy fresh farm produce reaches all, everywhere. Remember, the pack-house is the first step for entry into the cold-chain.







#### **EL NIÑO**

El Niño is considered a sure thing in 2015. In December 2014, the Japan Metrological Agency had declared It's onset, on the basis of rise in ocean temperature though other atmospheric conditions had yet to prevail. Now the Climate Prediction Center of USA has confirmed the arrival of El Niño conditions. Though these conditions are weaker than expected and have manifested much later than was foretold, scientists continue to predict that **2015 will be the hottest year in recorded history**.

The El Niño effect results in not just momentary peak in air temperatures, but higher than expected temperatures that can last for weeks. The last major El Niño was in 1998 when Indian Ocean temperatures rose by 3°C with associated weather impact. We shall have to wait and see how these predictions fructify, for a final measure of the increase in temperatures. Its eventual impact in India is not always correctly predictable due to various factors. Nevertheless, cold-chain users are advised not to take lightly any forecast of hotter than normal temperatures.

#### Preparing for hot temperature operations:

Raised air temperatures directly impact on running efficiencies or the mechanical equipment, increases machine breakdown risk and can even damage old rubber seals or cause physical distortion in some structures. All cold-chain operators, should evaluate the age of their mechanical equipment, insulation and review their periodic maintenance systems. Damaged insulation should be renewed or repaired, oil changes are advised in all mechanical engines (reefers, generators, compressors, etc.), rubber gaskets can be renewed ahead of normal cycle. El Niño can result in a dryer than normal environment, hence, expect more dust and keep extra air filters handy. Calibrate all temperature sensors, as well as high temperature cut-outs on equipment. Consult your engineering support teams for individual maintenance needs.

Keep your ante-room equipment in good order to avoid risk of temperature excursions. In case of stored products that require frequent fresh air replenishment, re-evaluate your practices so as to conduct this activity at the lowest temperature point of a day. Where feasible, adjust to skip a refresh cycle in the peak temperature period. During hot dry spells, rodents and birds will try to access your cold spaces, keep pest prevention measures at peak. High sea and air temperatures can also result in unnatural monsoon rains - keep roofs, gutters and drains clear; replace brake pads and wipers of your reefer trucks in advance.

**El Niño** - is the warm phase of ENSO (El Niño Southern Oscillation) - a phenomena that occurs on average every 5 years and disturbs sea surface temperature patterns in the Pacific Ocean, and weather patterns worldwide. The opposite, or the cool phase of ENSO is called La Niña.

A natural phenomena, the El Niño cycle is not fully understood but has been observed to occur repetitively every 3 to 7 years. It's effects are not limited to Pacific Ocean temperature fluctuations, but are known to impact flood and drought occurrences globally. Old farmers in rural India, can share traditional folk lore and poetic sayings that narrate of a five yearly cycle of drought. This seems to stem from a traditional memory mechanism that may relate to the effects of the phenomena now known as El Niño.

The Oceans absorb the majority of the extra heat put out by global warming and during El Niño, some of this heat is released back into the atmosphere, causing the warm up, worldwide.

El Niño 2015 is expected to push temperatures to new highs globally, peaking between June to August in Asia. A strong El Niño, has a 'butterfly effect' in impact elsewhere. The changes to precipitation patterns by an El Niño can changes in occurrence of tropical cyclones, floods, drought, etc. These have direct effect on flora fauna of regions, agriculture yields, etc.





In Neutral Conditions, the easterly Trade winds, blowing from the west coast of South America piles up the warm water along the eastern shores of Asia. Along the shores of Indonesia, the sea level is almost half a metre higher than that off South America, and sea temperatures are also about 8°C warmer. The warm sea water results in the rain cycle and shapes the jet stream which shapes weather system globally.



Due to debated reasons, the prevailing Pacific trade winds get disrupted and the warm water (at a higher level) off Asia flows eastwards, getting pulled down by gravity. A persistent westerly wind from the Asian shore is also set off. This results in a shift to the jet stream, causing other weather disruptions worldwide. In India this can result in droughts, a following rise in the Indian Ocean temperature, which thereafter has consequences in the form of heavier than normal rains.



February 2015



#### **COLD-CHAIN INSIGHTS**

Cold-chain value systems and options to be considered by planners.

**1.** The strategic business interest & capability of any concerned enterprise will define the scope and extent of the value chain of each such enterprise. Frankly, the involved models are easily differentiated and would extend across the following two basic categories-

a. **Uninterrupted farm-to-fork sourcing and distribution** of agricultural produce, especially perishables, wherein the fresh whole food does not undergo any change to its primary and natural characteristics. This value chain system is empowered with the agri-logistics intervention that services an out-reach into

multiple markets through connectivity. This market link is key to generate a revenue stream that is volume based, and in turn feeds improved post-harvest handling, resultant growth in produce quality & productivity and also offers scope to stabilise demand-supply fluctuations.

This model comprises value chains that complete the direct farm-to-fork connectivity and relies majorly on pack-houses and transportation to precondition the harvest, connect with

cold stores which serve as a front end hubs for the logistics activity, and onwards to last mile retail. The entire logistics chain seamlessly extends from farm-gate to multiple consumption centres, across regions. There is no interference with the primary and intrinsic values of the fresh food, as it does not undergo any transformative change or food processing. Collaboration among cold-chain asset owners is a norm. This unbroken value chain system is most prevalent globally, and is almost non-existent in the domestic arena.

b. **Interrupted sourcing and distribution** of produce, primarily of two types-

i. Suitable raw material is sourced for industrial processing units for transforming into a manufactured food item. An interruption in the food distribution chain occurs in way of a food factory wherein the primary natural characteristics of raw produce is effected through ingredient additives, physical or chemical change, etc., so as to change the fresh produce into a new product with a revised value. The product is no longer characterised as fresh whole food, and is subject to predetermined expiry, labelling and value added tax compliance. This value chain is not about seamless custody of value from farm-to-fork, typically relies on sourcing culled produce and/or sourcing special cultivars through contractual arrangements in case of perishables. The key cold-chain intervention is normally in the form of primary storage which may be captive to an industrial facility, to feed the processing line(s).

The output from the production lines may not require subsequent cold-chain intervention. This form of interruption in the value chain is unmistakable in the food processing industry in cereals, potato, tomato, beverages and similar sectors. With new processing technologies being researched, more developments can be anticipated, though conversely, a greater demand for fresh whole foods is also foreseen due to health concerns. To a large extent, this value chain system is market linked or demand driven, is highly competitive and its development is well established. The product value realisation is not directly linked to farmers, as the value of the harvested produce is broken, and the primary value is interfered with.

ii. Bulk inventory holding of fresh farm produce for a delayed or timed trade. The intended use is to buffer against episodic production and supports a price arbitrage trading model, making it partisan to a propensity to control supply. The primary cold-chain intervention is in the form of standalone static infrastructure (cold warehousing), quite prevalent in case of potatoes and spices where no other cold-chain connectivity is employed. If ownership of produce remains in farmers custody, value realisation to farmers is possible. This value chain system is









opportunistic and commonly established by traders or by Government for crops subject to MSP (case of food grains, this manifests as stocking surplus for food security or trading purposes). The delivery system is interrupted, value is kept pending the "right time".

In both above value chain systems (1a, 1b), the primary value being engaged is the farm produce or a manufactured product, with logistics being a tool to facilitate the trade. To unlock the value chain to its fullest extent, the strategic business interest needs to manage multiple activity components of the involved supply chain, especially in the case of direct farm-to-fork supply of fresh perishables.

**2.** In the first model, the business is that of managing the perishables supply chain, and the primary and preferred intervention is to expand market access through a seamless logistics network, rather than holding inventory for deferred trade and raising complex inventory holding risks. For greater benefit of farmers, the objective of promoting uninterrupted logistics, so as to expand market footprint is understood to be more beneficial. Expanding the supply chain systems also helps to stabilise demand-supply mismatches.

In cases where the infrastructure developer is not integrated with the produce centric value chain, such a developer's scope is automatically limited to the realisation received from rental charges from the logistics infrastructure created. This limited approach is distinct in the non-cold-chain logistics sector and has been the precursor in domestic cold-chain development. Since cold-chain can have direct impact on produce longevity & quality, price realisation and source production, it is recommended that cold-chain be strategically furthered under the first model (1a - uninterrupted logistics) and variations thereof. This primarily means developing many more pack-houses with precoolers and at the least, quadrupling our reefer truck fleet along with multimodal rail options. This also means an investment in multiples of what was conventionally expected.

**3.** Poor capacity utilisation is oft spoken of, but as in any business, it arises from unconsidered location or design of the infrastructure, or from over ambitious evaluation of capacity and resources required, or from flawed market linkage and operative models. Poor capacity utilisation is more common in the single commodity storage model, where capacity use depends on vagaries of a single harvest. This model depends on sourcing produce in a season of glut for deferred and timed trade and like all commodity trade, the model is more sensitive to supply dynamics. However, it is pleasing to note that as per a recent 2014 baseline survey of cold storages nationwide, the respondent owners report having achieved, on average, 74-75% capacity utilisation every year over the previous 3 years. This survey had first-hand participation of 93% of the cold stores (more than 5000 units) open for service/lease, and did not include the storage created specifically for an organisation's captive use.

It is also to be noted that the majority of cold-chain businesses developed with Government support, by various private enterprises, are known to have met success, resulting in growing trade of the produce and in turn has promoted high productivity in those areas. This can best be illustrated in the case of grapes, which resulted in India reaching topmost in grape productivity, globally. Yet, units set up as 'common infrastructure' by State Government agencies, have not met similar success.

**4.** The recently revised and rationalised incentives along with the low interest Warehousing Infrastructure Fund are aimed to promote wilful entrepreneur participation across the multiple infrastructure components, that are necessary for building integrated logistics chains. The scheme does not ignore the existing infrastructure footprint, and allows modernisation in technology.

The revised scheme for cold-chain, allows component development for collaborative uses as well so as to develop further the eco-system. This will lead to unlocking the value system to its fullest extent as other developments are simultaneously undertaken.

There is no restriction, other than technical constraints, to multi-commodity uses of the infrastructure developed - the schemes do not restrict synergistic use for non-horticulture or non-agri products. It may also be noted that the norms based subsidy schemes are open ended and designed to strategically promote components for operational & energy efficiency and to multi-modal handling across both existing and new infrastructure. Users can therefore develop as per operating needs and expand their value chain.

Government schemes are aimed to provide incentive so as to strategically drive development in specific domains and missing components in the logistics chain. Objective of such incentive/subsidy is





to promote conformity for future ready distribution networks, environment safe guards and energy efficiency and promote long term operational viability

5. Cold-chains are value chains that are not to be viewed as restricted to a cachement cluster, but are most effective when they break the regional or distance barrier. Hence, cognisance should be taken to develop cold-chains that span multiple states and regions, rather than a specific area - an integrated value chain approach, across regional boundaries is preferred.

The financing options for a cold-chain developer are various. These include low interest funds 6. from NABARD, norms based subsidy as an incentive to adopt normative technologies, FDI, PPP-VGF option, commercial banks, etc.

7. A complete cold-chain (integrated uninterrupted variety) requires the ability to manage

components at multi-locations (across States) and involves transport operations. This refers to the need to have thousands of pack-houses - the clear missing links in the cold-chain. Specifically this requires village level pack-houses with modern preconditioning facilities and with the associated transport links.

The Government's VGF scheme seems to be a worthwhile option for enterprises to take advantage of, and develop a cross regional spread of multiple pack-houses with transport. To fulfil VGF norms, these will require to be operated as a service for local farmers, with the viability gap in service fees and their seasonal utilisation being assessed for gap funding. Effectively, the concessionaire will be able to spearhead supply chain practises and market linkage, with associated capacity building at near farm establishments.

Enterprises can also seek to develop businesses that will spearhead rail/road/multi-modal transport options for cold-chain. Large scale transport connectivity through a VGF-PPP model for long haul rail/road/water movement is a worthwhile consideration. This will immediately network the vast sub-continent to access fresh food from various growing areas.

The concept of developing an All India Cold-chain Availability 9. Platform (ICAP), as an IT enabler that delivers information on spare and active capacity, piped into public domain for access by users and government agencies, is also an opportunity for many. ---- XXX ----

On a national level, the objective to boost rural incomes (by reducing spoilage or through increased value addition), could best be served by providing cross regional logistics connectivity, thereby empowering access to multiple buyers/markets for fresh produce.

Cold-chain is the sole option that overcomes limits of perishability, to sell fresh into more markets; promotes faster returns; larger number of transactions; enhances revenue; maximises price realisation with minimal need of added inputs; and demonstrably promotes produce quality and higher productivity.

For further inputs towards cold-chain development, a study is underway which applies an inverse approach. This study involves an assessment of consumption / demand of fruits and vegetables, as the basis to arrive at the infrastructure gap to effectually cater to such demand - the study is delinked from earlier approaches (by private and public researchers) which assessed infrastructure requirements on the basis of production (supply side) alone.

#### Strategy (The How)

- A strategy is the logical approach that will be employed to help achieve objectives. The general plan of action is described, but specific activities are not detailed in the strategy statement.
- A strategy, therefore, does not describe desired outcomes of a plan - those are already stated objectives. A strategy, however, delves into elements of both objectives and tactics.
- Strategy statements specify the key approach involved on how objectives can best be achieved.
- Directionally long term to deliver or bring to logical conclusion a target statement or mission over a defined horizon of time.

#### Tactics (The What)

- Tactics are specific actions taken to achieve desired outcomes, taking several key but abstract elements of a strategy, turning them into something concrete.
- Needs cascade effect with actionable steps right from the first act onwards.
- Driven by core strategy to address short term hic-cups and to course correct.

This is a first such demand driven study and NCCD invites all concurring stakeholders to contribute wholly towards these ongoing efforts.



## National Centre for Cold-chain Development

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#### **POST-HARVEST COOLING**

Proper post-harvest cooling means removing field heat at suitable humidity levels, which will:

- Suppress respiratory activity and enzymatic degradation (softening).
- Slow down and inhibit water loss (wilting).
- Slow or inhibit the growth of decay-producing microorganisms (moulds and bacteria).
- Reduce the production of ethylene or minimize the commodity's reaction to ethylene.

In addition to protecting quality, post-harvest cooling enhances marketing flexibility by making it possible to transport fruits, vegetables, and flowers for longer durations, to make a sale.

The Field heat removing or Cooling method and choices depend on several factors, including:

- Temperature of crop when harvested.
- Nature of the commodity(ies) (e.g., leafy, flowers, fruit), its respiration rate(s), cooling needs, lowest safe temperature, tolerance to water exposure.
- Product packaging; Box, bin, or bag; packaging materials and design configurations affect method and rate of cooling.
- Product throughput capacity; Volume/mass to be handled per unit time will determine the cooling method and scale.
- Mix of commodities; Compatibility depends on their nature with regard to sensitivity to odours and volatiles, such as ethylene.

#### **Common Cooling methods**

- **Room cooling**: Produce is placed in an insulated room equipped
- with refrigeration system. A room used to store previously cooled produce requires a relatively small refrigeration unit, however, if used to pre-cool produce, a larger unit is needed. Used for potatoes, chillies, etc. This method is not recommended for most commodities, as it is too slow compared with other options.
- Forced-air cooling: High speed Fans are used in conjunction with a cooling room to pull cool air through the packages of the produce. Although the cooling rate depends on the air temperature and the rate of air flow, this method is usually 75–90 percent faster than room cooling. Air temperature must be kept above chill point. To avoid over-cooling and dehydration of produce, do not operate forced-air fans after the produce has been cooled to its optimum temperature.

Water removes heat about five times faster than air, but is less energy-efficient due to losses. Underground water is a good option, as it usually comes out of the ground with temperatures in the 20-25° C range. Further refrigeration to reduce water temperature is carried out. Use of a disinfectant in the water is recommended to reduce the risk of spreading diseases.

- Hydro-cooling: Dumping produce into cold water, or running cold water over produce, is an efficient way to remove heat, and can serve as a means of cleaning at the same time. In addition, hydro-cooling deters water loss and wilting. Hydro-cooling is not appropriate for berries, potatoes to be stored, sweet potatoes, bulb onions, garlic, or others that cannot tolerate wetting.
- Icing: Icing is particularly effective on dense products and palletized packages that are difficult to cool with forced air. In top icing, crushed ice is added to the container over the top of the produce by hand or flaking machine. In case of liquid icing, a slurry of water and ice is injected into produce packages through vents or handholds. Icing methods work well with high-respiration commodities such as sweet corn and broccoli. One Kg of ice will quickly cool about three Kgs of produce from 30° C to 4° C.
- Vacuum cooling: Produce is enclosed in a chamber in which a vacuum is created. As the vacuum pressure decreases, water within the plant evaporates and removes heat from the tissues. This system works best for leafy crops, such as lettuce, which have a high surface-to-volume ratio. To reduce water loss, external water is sprayed on the produce prior to placing it in the chamber. This process is called hydrovac cooling. This is the most rapid and cost-effective operation for cooling. The primary drawback to this is the cost of the vacuum chamber system.

-as explained by our CEO, Pawanexh Kohli



#### LUMINARY SPEAK



#### Shri Mohanbhai Kalyanjibhai Kundariya Minister of State, Ministry of Agriculture

## The Agriculture scenario is undergoing changes. Where do you see the major impact areas?

Agriculture will remain a mainstay for India's growth and it will improve because of greater use of technology. While large part of the country is still dependent on monsoon, improved water resource management is an n important ongoing change. Similarly, intelligent use of fertilizers and improved farming practices will result in growing productivity. Agriculture is directly linked with the consumers and this is visible in the shift towards crops like horticulture. As a country develops, and people have more spending money, there is increased demand for fresh fruits and vegetables. If consumer can

afford, they prefer freshly made juice to juice out of a can. This shift in demand has resulted in better quality of harvest and larger production of fruits and vegetables. This is a major impact area. Next step is making sure the harvest is not wasted but reaches the markets. For this, the role of cold-chain in case of fruits and vegetables is important.

## Cold stores are quite successful in case of potatoes and spices. There is already good capacity for these crops.

Yes, private entrepreneurs have developed cold stores to serve as efficient platform and build a seasonal buffer in such crops. But as more areas get under potato cultivation and production increases, there will be more demand for such type of cold stores. In Gujarat, we can already see increased development of cold stores for potato. Not only potato, there are other crops which should also benefit from cold-chain technology. Unlike potato, most fruits and vegetables cannot stay in cold store for very long but in they will benefit from cold-chain because of better post-harvest handling and by connecting to reach more consumption areas, while staying fresh. That is an area for development for NCCD to focus on.

#### The Budget has also proposed relief for back end operations for cold-chain.

The Government has done this to attract more interest in farm gate operations. The exemption from Service tax when providing services in the back-end will help the development of modern pack-houses. The pre-conditioning of fruits and vegetables is important so that they can be safely transported without damage. An important benefit of cold-chain for fruits and vegetables is the cleaning and packaging, which is important to reduce the handling losses. Making sure that the farmer's harvest can reach the consumer while it remains fresh is the important role of cold-chain.

