

Workflow: Packhouse Management

Toolkit 4.1

Packhouse Planning, Layout and Process Flow

target audience

Packhouse owners, and managers.

what it is

This toolkit focuses on the key factors that should be considered when planning the location, design, and layout of a packhouse. This includes:

- Long term objectives and planning.
- Infrastructure.
- Layout.
- Process Flow.
- Technology and automation.

It is impossible in this handbook to provide a definitive and detailed resource for the planning of a packhouse, but the success factors listed provide a useful summary of the most important considerations.

why it is important

Planning a new packhouse is a big investment and a strategic decision that aims to provide the processing capacity and financial return for decades, at a competitive operating cost. Technology and automation are evolving quickly and increasingly determine competitiveness of the operation. Furthermore, meeting packhouse accreditation criteria related to sustainability, water and energy use, and environmental impact is becoming mandatory in many markets. Therefore, planning and design are central to achieving a profitable, competitive, and sustainable operation. Finally, human capital and the skills to manage the packhouse are as important as the asset itself.

success factors

- **Strategic planning** – Making the strategic decision as to whether a new packhouse is needed, whether the site is suitable, and then building a facility that is competitive, efficient, and will serve your, and your markets needs for its anticipated lifespan, requires significant planning and anticipation. Consider the following key success factors in your planning process:
 - **Accurate supply and demand planning** – A reliable forecast of the fruit to be packed, now and in the future. This includes both volumes and varieties, as well as the picking and processing windows for the expected cultivars. Both passive (based purely on historic trends of both supply and demand) and active forecasting (based on anticipated supply, the development and expansion of production, and future market demand) should be applied. A planning window of 15-20 years is advisable.
 - **Location** – Assessing the suitability of the site, from a physical perspective (land, infrastructure, geotechnical) and from a regional capacity perspective, i.e., the capacity, including spare packhouse and processing capacity within the region.
 - **Capacity and utilisation** – Deciding on the capacity you intend designing for is an important factor and will take the above two factors into consideration. Designing for maximum capacity can be expensive if that capacity is only required for limited, peak times, i.e., overall utilisation will be low. An under-capacity design, especially if this is done without the ability to expand at lowest cost (a clear expansion plan and framework), will compromise both your strategic and operational objectives. Factors such as utilising other packhouses during peak times, or packing other tree fruit to increase utilisation, should be considered.
 - **Lifespan** – The actual packhouse building can last for many decades and if designed well to allow expansion and flexibility will serve its purpose during that time. However, machinery, and in particular sophisticated, software-enabled equipment has a limited lifespan, e.g., 10-12 years. Your planning should include replacement and upgrading of equipment.
 - **Expertise** – Access to the necessary expertise is vital:
 - Numerous components of your packhouse plan will require specialist expertise, and you should aim for the best advice possible. This would include geotechnical assessment, industrial engineers and architects, environmental experts, regulatory advice etc.
 - Your will require permanent operational and management expertise. Expertise is scarce, especially in certain rural areas. Furthermore, even if there is a legacy of packhouse management in the area, the latest, modern technology requires new skills that cannot be handed down by the previous or current generation.
 - **Lead times** – In general you need about 3 years from conception to the completion of a new packhouse.
 - **Managing constraints** – No environment or plan is without its constraints, and your plan must factor in the realities, constraints, and limitations, and where possible mitigate them.
- **Infrastructure** – Most packhouses are built on or near the farms it serves. Given the often, rural location, infrastructural considerations are an important success factor:
 - **The site itself** – The land should be flat, within more than adequate space, with sound geological characteristics.

- **Location and access** – The location should be close to the production units and close to a national road to avoid excessive travel distances on dusty and possibly rutted roads, both of which damage fruit. If rail transport is an option (sadly decreasingly so), proximity to a railway station or railway siding, and ideally a rail link directly from the packhouse, is ideal.
- **Regulatory compliance** – If the packhouse leads directly onto a national road, certain road regulations must be met.
- **Water** – Water is critical, firstly in terms of availability and sustainability, but water quality is also important. Although water can be treated, careful consideration should be given to water quality, as this has a direct bearing on how much additional effort and treatment, i.e., time, facilities, and operational cost, will be required to produce good quality water. Key factors are:
 - Physical contaminants – Clay, silt and sand, as well as organic debris such as plant remnants, seeds, and aquatic flora and fauna. Such water must be filtered and treated prior to use to prevent blockages.
 - Total suspended solids (TSS) – TSS and soluble salt levels have an impact on the efficacy of certain treatment chemicals. If the salt levels are above a certain range, it may be necessary to find an alternative water source. Filtration and treatment are expensive.
 - Bacterial contamination – Similarly, high levels of bacterial contamination compromise the efficacy of fruit treatment chemicals and fungicides and can also contaminate the treatment/washing system itself.
 - pH value of water – Maintaining the correct pH is vital, e.g., chlorine is 3 times more effective at a pH of 7 than at a pH of 8.
 - The water eco-system and infrastructure – Sadly, fresh water source management is increasingly poor and rivers, dams and even ground water can be compromised. Testing and the necessary treatment are critical.
 - Back up supply – South Africa is a water-stressed country, and together with poor water (supply and quality) and sanitation management by municipalities you should always have a contingency supply in case of interrupted supply. This could in the form of dams and rainwater harvesting storage.
 - Wastewater treatment – Environmental management is a high priority, and many accreditation schemes require clear and safe wastewater protocols.
- **Power** – Reliable, good quality power supply is a vital success factor. South Africa suffers from inconsistent supply and as well as poor quality electricity with surges and dips potentially damaging machinery and in particular software driven equipment. Alternative power supply is mandatory, e.g., hydro-electric, or generators, or solar/renewable systems. Renewable power systems, and their storage technology, are becoming less expensive and more effective.
- **Connectivity** – Wifi and internet connectivity, as well as cell phone connectivity, is mandatory. This may require satellite technology if the land-based technology is lacking.
- **Layout** – The packhouse layout should meet the following fundamental requirements:
 - **Receiving** – The key requirements include:
 - Adequate space for the receiving bins.

- Isolated and separate from the production area to limit and contain dust and spores.
- Close to the drenching systems and de-greening rooms.
- Ideally, under roof to protect the incoming fruit, especially if it is held there before being processed.
- Carton store with the necessary fire protection measures.
- **Production/Processing** – Systematic and efficient layout of the following (not necessarily in exactly this order):
 - Wet or dry tip
 - Pre-sorting
 - Pony sizer
 - Washing system
 - Drying tunnels
 - Main sorting
 - Fungicide and wax treatments
 - Final sorting
 - Automated grading and sizing
 - Packing
 - Palletisation.

The remaining toolkits within [Workflow 4 – Packhouse Management](#) address these in greater detail.

- **Dispatch** – Dispatch is often a bottleneck area when packing and dispatch is at its peak. Key elements include:
 - Space, for pallets, transport, and containers.
 - The pallet store, including racking systems for the efficient storage and accessing of pallets.
 - Space for repacking
 - Adequate capacity based on the storage space, the storage duration, volume, and the availability and scheduling of transport.
 - A dedicated area for inspections with the requisite laboratory and testing equipment.
- **Water and energy systems** – These can be housed separate from the main packing and production area.
- **Cold storage** – Where this is a requirement, depending on the destination market, the downstream logistical chain, and the location of the packhouse.
- **Staff and admin areas** – These facilities also need to be carefully planned, with consideration given to:
 - Noise
 - Easy accessibility to the packhouse.

- Location of the control centre.
- Staff numbers during peak season, with adequate ablution and canteen facilities.
- Meeting areas, which do not necessarily need to separate rooms, but should be designated spaces for this purpose.
- Training rooms, with the canteen designed so that it can double as a training facility at appropriate times.
- **Flow** – Ergonomics, workflow, and movement are key considerations:
 - Avoid crossing traffic areas, e.g., forklifts and human traffic crossing.
 - Get the best design advice to make movement (reaching, bending, lifting, packing, sorting) as easy as possible.
 - Incoming and outgoing transport, especially at peak season when many vehicles and people move in and out of the facility.
 - Assess how much time is spent waiting, walking, or working - design to limit the first two.
- **Expansion** – Ideally you will have designed your packhouse facility and space in a way that allows for expansion at lowest cost. If you know that your capacity will need to expand over time, ensure that the footprint, even if it is not productive space yet, allows for flexibility and expansion as your capacity requirements increase.
- **Technology and automation** – Key considerations include:
 - Careful due diligence to ensure that technology is truly fit for purpose.
 - Cost vs benefit.
 - Competitiveness.
 - Carefully weigh up flexibility vs efficiency, as well as automation and the need/cost of labour. There are numerous examples of technology and automation functioning at significantly lower levels than it was designed for (and which was paid for), as well as cases where despite the investment in technology, labour still needs to be engaged to compensate in some unforeseen way. In short, do your homework!
 - Excellent procurement practice.

assessment questions

Please Note: There is no minimum / maximum number of questions you can add.

1.	Is your new packhouse plan based on a rigorous strategic plan?
2.	Have you considered and mitigated all the constraints, both regional and infrastructural?
3.	Have you designed for the best layout, and if you have had to compromise on size or space, does the design and workflow mitigate some of these constraints?
4.	Do you have room for expansion or layout improvement and flexibility?
5.	Have you procured the best specialists, such as industrial engineers, architects, and technology experts?

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| 6. | Do you comply with all the national and municipal regulations? |
| 7. | Do you have good professional relationships with all the stakeholders, including local authorities, that will enable the successful establishment of the packhouse? |
| 8. | Do have an accessible skills and talent pool you can draw from? |

resources

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| 1. | Citrus Packhouse Module 1 – Packhouse Overview (Citrus Academy) |
| 2. | Citrus Packhouse – Overview (Citrus Academy) |
| 3. | Citrus Packhouse Module 2 – Packhouse Infrastructure and Planning (Citrus Academy) |
| 4. | Citrus Packhouse – Infrastructure and Planning (Citrus Academy) |