

The One Man Factory

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March 2025



Overview

01. Full-Stack SW-HW Engineer
02. The Value Cycle
03. Industrial Revolution and AI
04. Key Implementation Choices
05. One Man Factory Case: SinaguaMalt
06. Summary



Full-Stack HW-SW Engineer

Fluency in hardware and software are needed for companies that build physical things.

Job Descriptions: Systems Architect, System Engineer, Hardware Designer

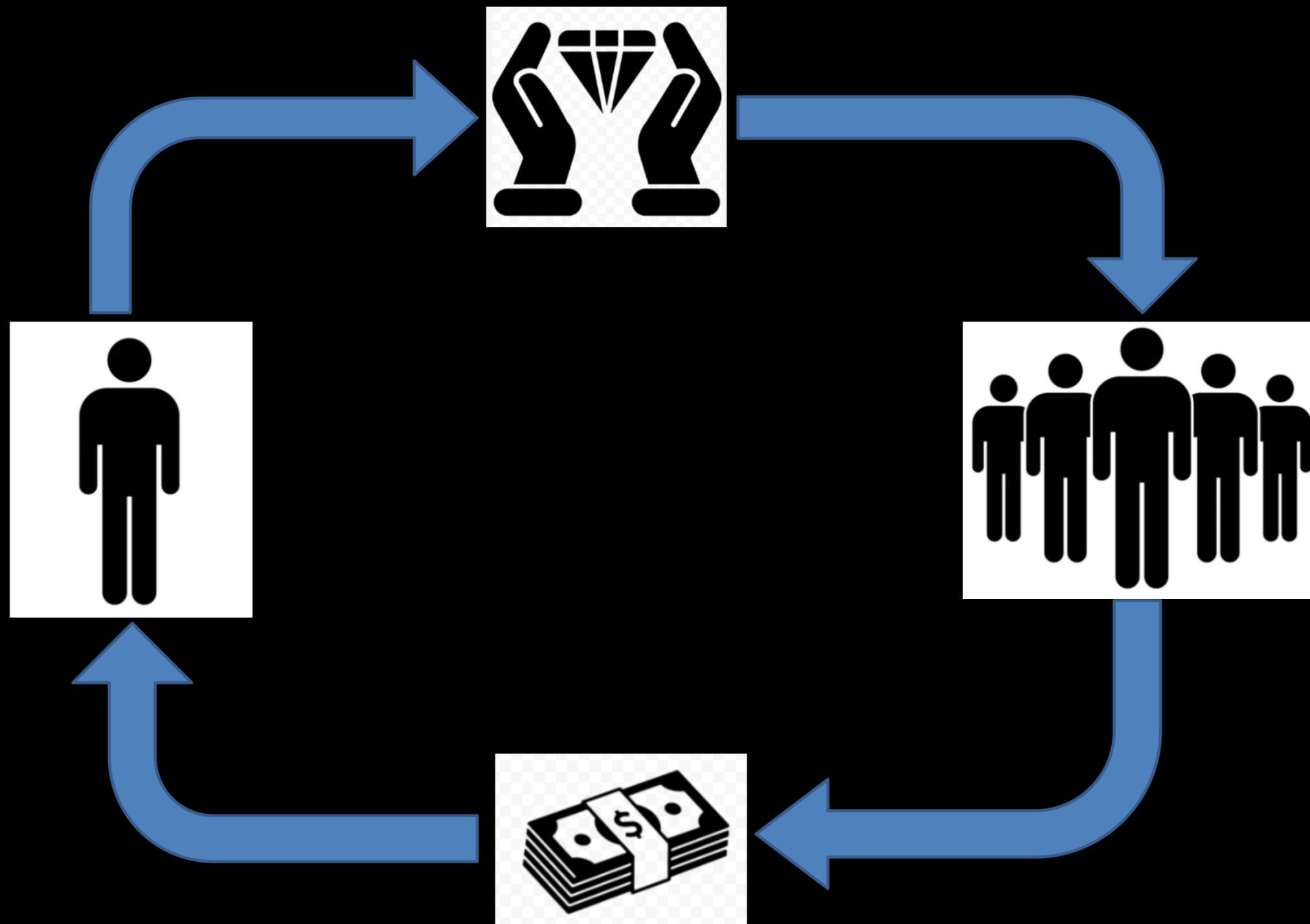
Coverage: mechanical design – electrical engineering – hardware design - abstraction level software

Enablers:

- Robot teleoperation and semiconductor manufacturing
- Next gen heavy industry looking for autonomous and remote operations



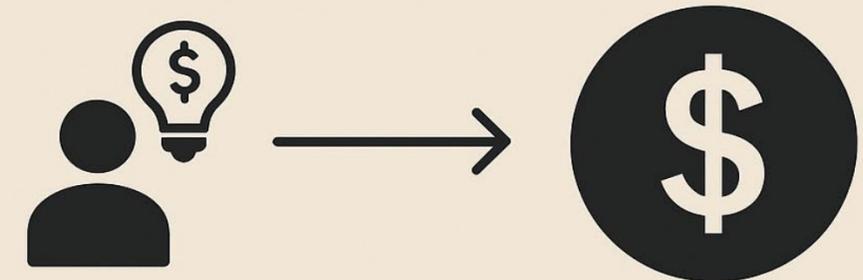
The Value Cycle



VALUE – MONEY

Value – generated by individual and evaluated by the community that needs it.

Money is just a currency for exchanging value.



When you ask for money, you are offering a produced value that has, in principle, already been evaluated and traded by others.



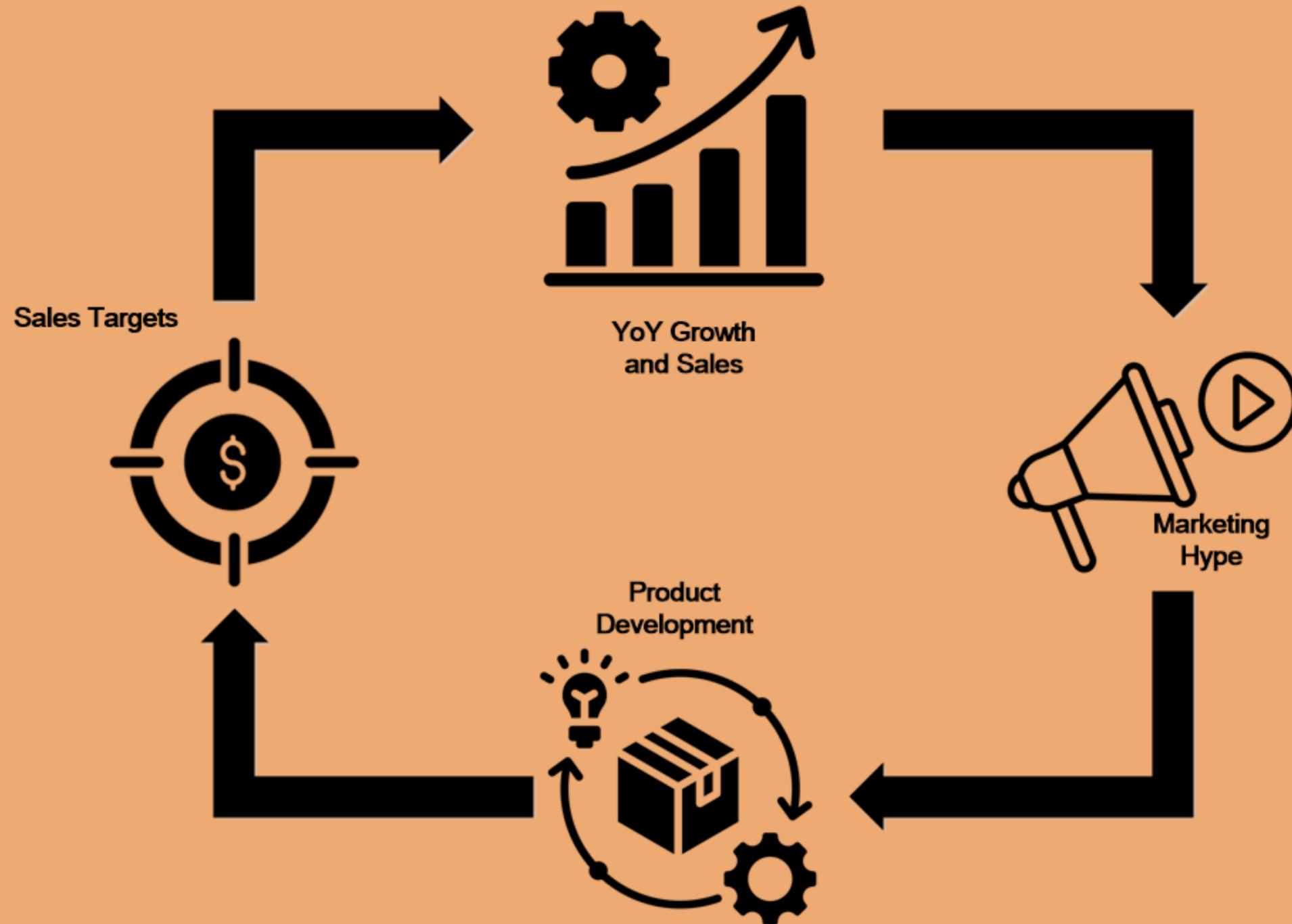
What value can you offer in exchange for the money you seek?

Who needs that value enough to consume it and be willing to pay the price for it?



Market Driven Product Development

Current Industry Strategy in Product Development



Consequence: sales results predicate technology innovation to the point it replaces it.

Tesla's automation problem

Overestimating Automation, Underestimating Humans

In 2018 Elon Musk's Tesla had serious production problems - Questioned on the matter, the company's CEO, said: "Yes, *excessive automation* at Tesla was a mistake. To be precise, my mistake. *Humans are underrated*"

The probability of small errors and unforeseen situations is proportional to the complexity of the process.



Problem-Solving Approaches

- *Searching for a solution vs. modeling and understanding* to predict outcomes
- The current trend of "searching for a solution" diminishes novelty
- Problem-solving should focus on modeling and prediction based on deterministic models as opposed to probabilistic



Evolutionary Traits and AI

- Compression and simplification are key evolutionary traits
- Humans compensate for complexity by developing simplified models
- Competition between search-based culture and modeling-based culture



Implications of Search-Based Culture

- The shift to a search-based problem-solving approach may become irreversible
- Possible split in problem-solving: search-based vs. model-driven
- Search-based culture could lead to stagnation as opposed to rational thought
- Rational thought aligns with natural selection and progress



AI and the Industrial Revolution

- Industrial Revolution 4.0 has underperformed; A new industrial revolution is emerging, balancing workforce and AI
- **Decision-making remains human-driven**, while AI supports data filtering and scenario simulations
- AI enhances efficiency but does not replace human judgment.



Efficient use of AI

- AI is useful for:
 - Data analysis
 - Pattern recognition
 - Scenario simulation
- AI is unsuitable for developing deterministic scientific models
- Decision-making remains a human responsibility



The One Man Factory

Technology has evolved to a point where manufacturing is ready for a new industrial revolution.

A processing plant that operates 24/7 with one person only – covering both operation and maintenance.

Requirements:

1. Predictability
2. Controllability and Observability
3. Graceful Degradation
4. Full SW Source Ownership
5. All resources local – no cloud



Key Implementation Choices

1. Distributed System:

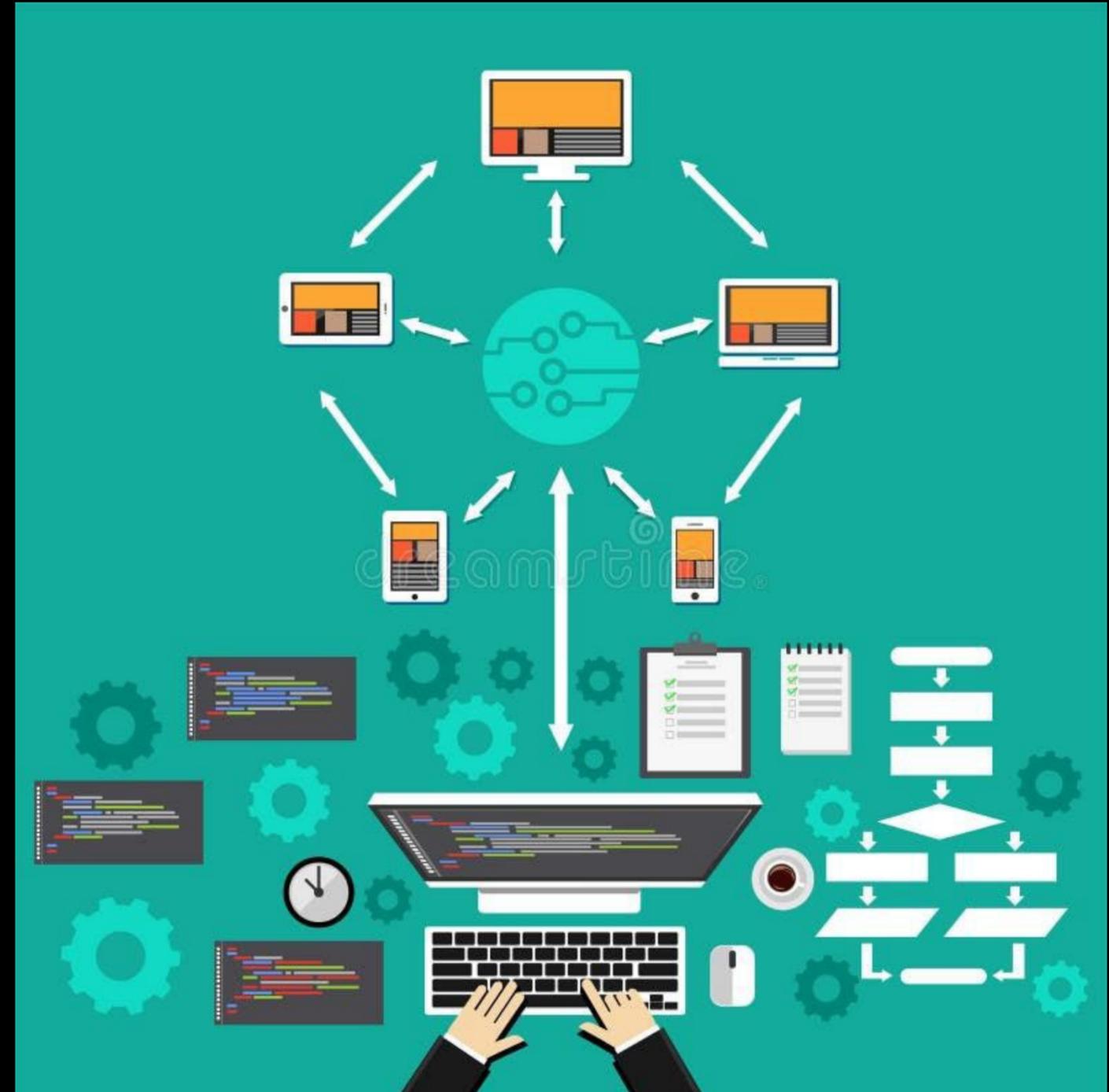
- Decoupled software development
- Reduced testing and debugging
- Graceful degradation easy to implement
- Easy to mix different technologies

2. Independent System Monitoring

- Fault tolerance
- Complex data acquisition

3. Design for Graceful Degradation

- Actuators can be switched to manual
- Design for minimum replacement time



Case: Sinagua Malt



Case: Sinagua Malt





SINAGUA MALT

Case: Sinagua Malt

Land Purchase – May 2021



Case: Sinagua Malt

Malting: Process timing

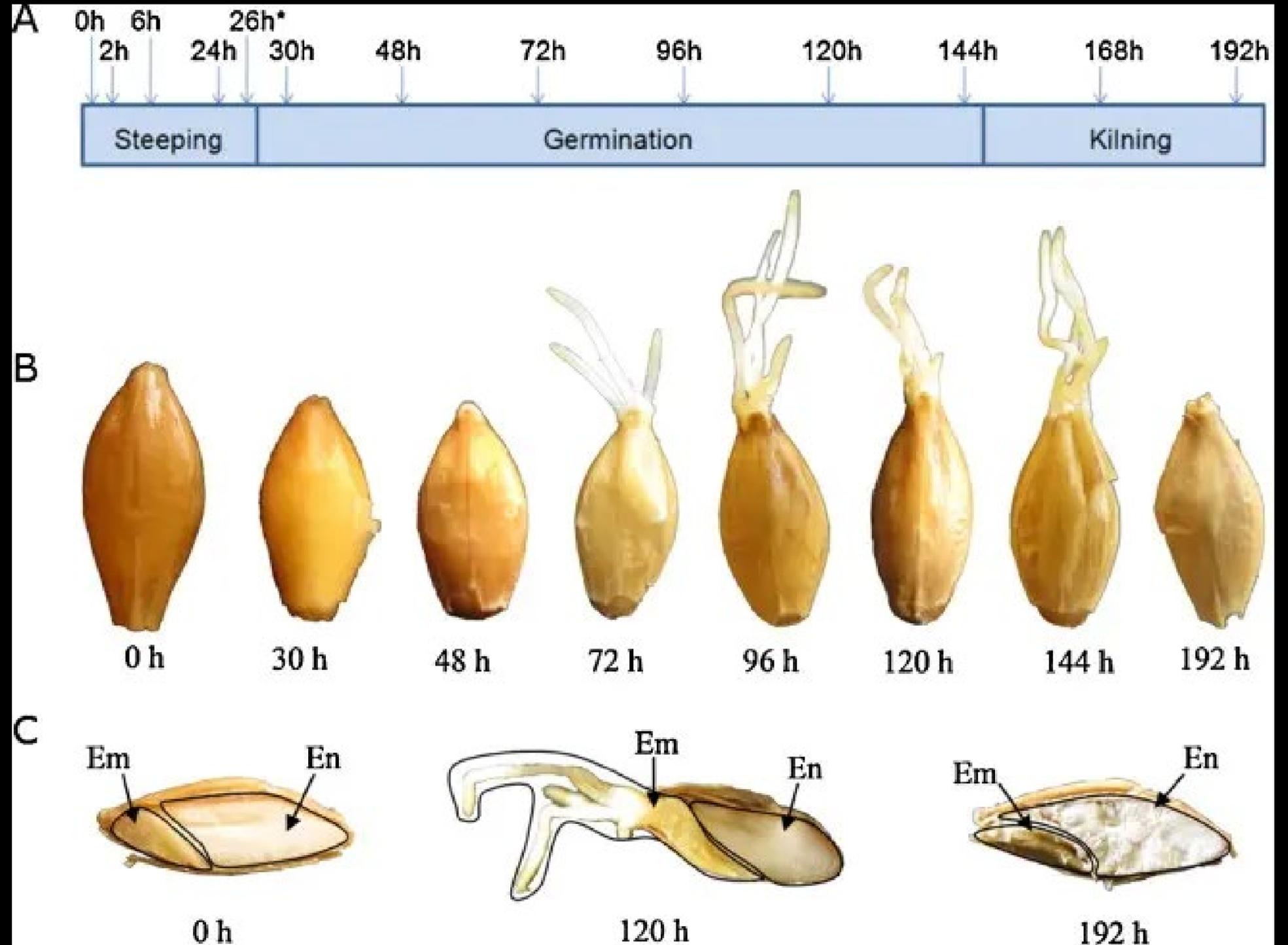
Malting is a controlled germination and drying process that changes the microstructure of cell walls, proteins, in barley.

The traditional process consists of

- steeping to increase the moisture content to a level required to initiate germination

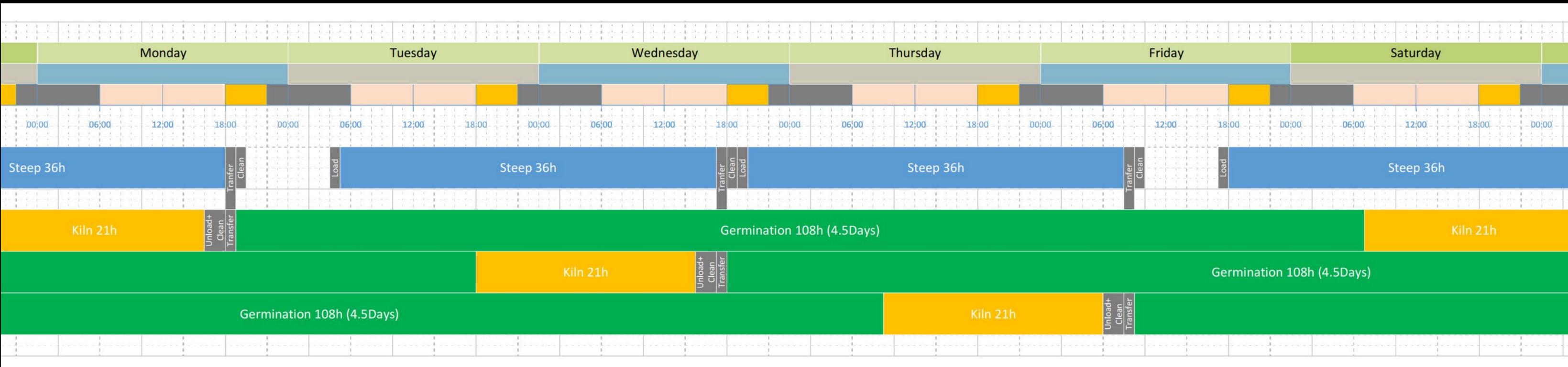
- germination to modify the kernel

- kilning to dry it to 4.5-5.5% moisture.



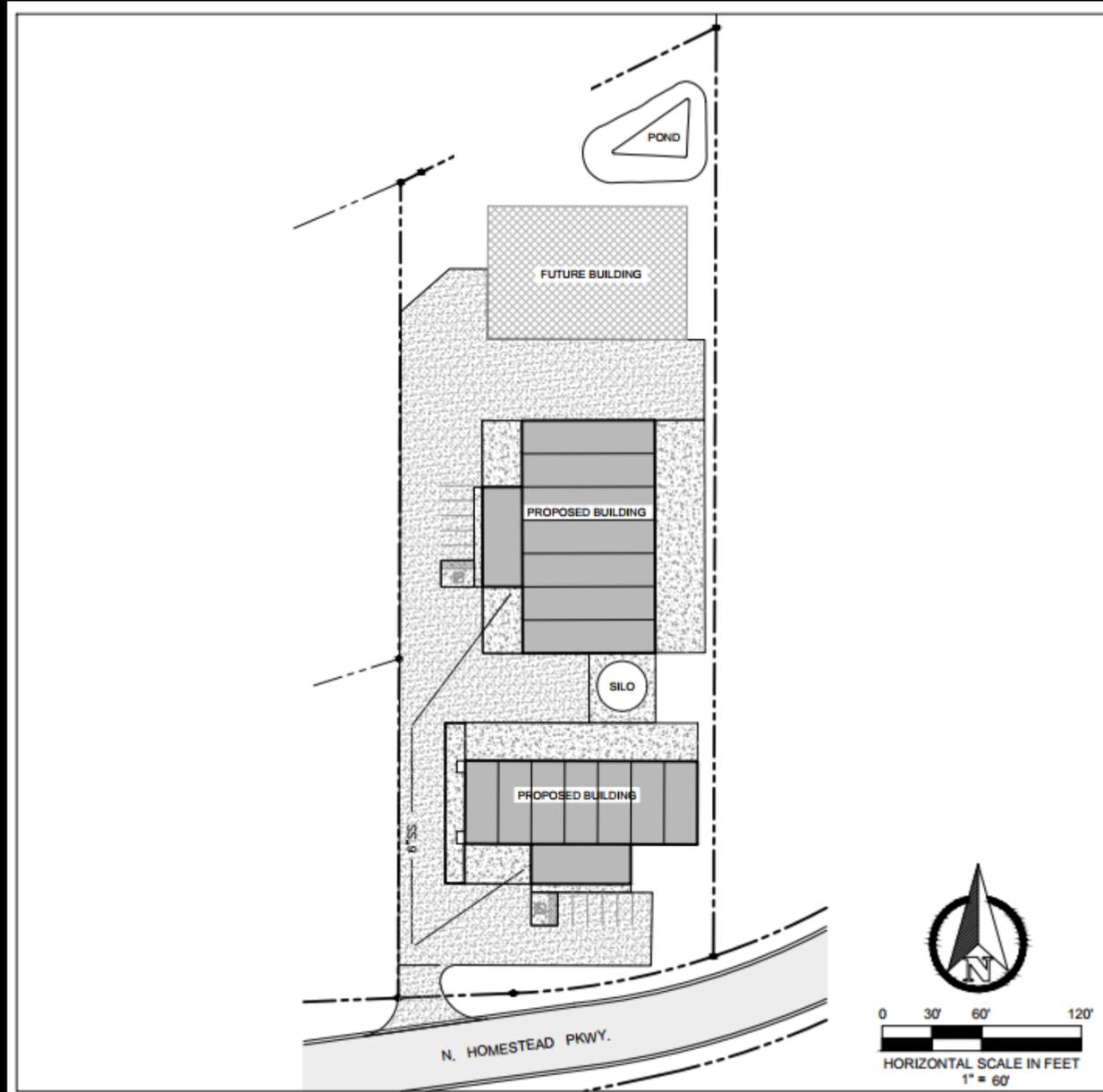
Case: Sinagua Malt

Plant Schedule – 24/7 operation

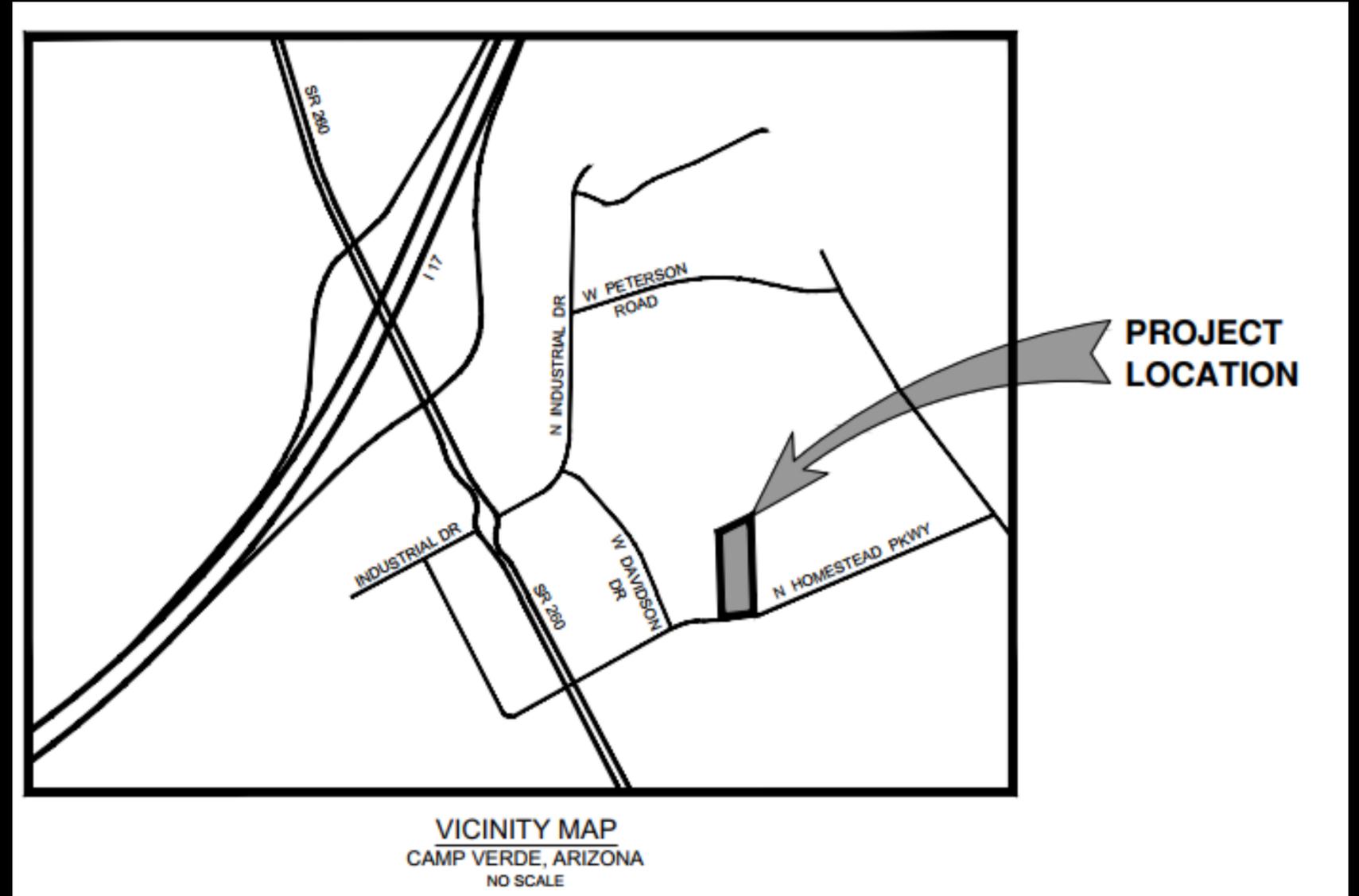


Case: Sinagua Malt

Site Layout



Site Location



Case: Sinagua Malt

Equipment delivered— May 2022



Case: Sinagua Malt

Foundation with tank supports



Case: Sinagua Malt

Tanks in place – May 2021



Case: Sinagua Malt

Vents Assembly



Case: Sinagua Malt

Testing and Debugging...



Case: Sinagua Malt

Dry Tests – May 2021

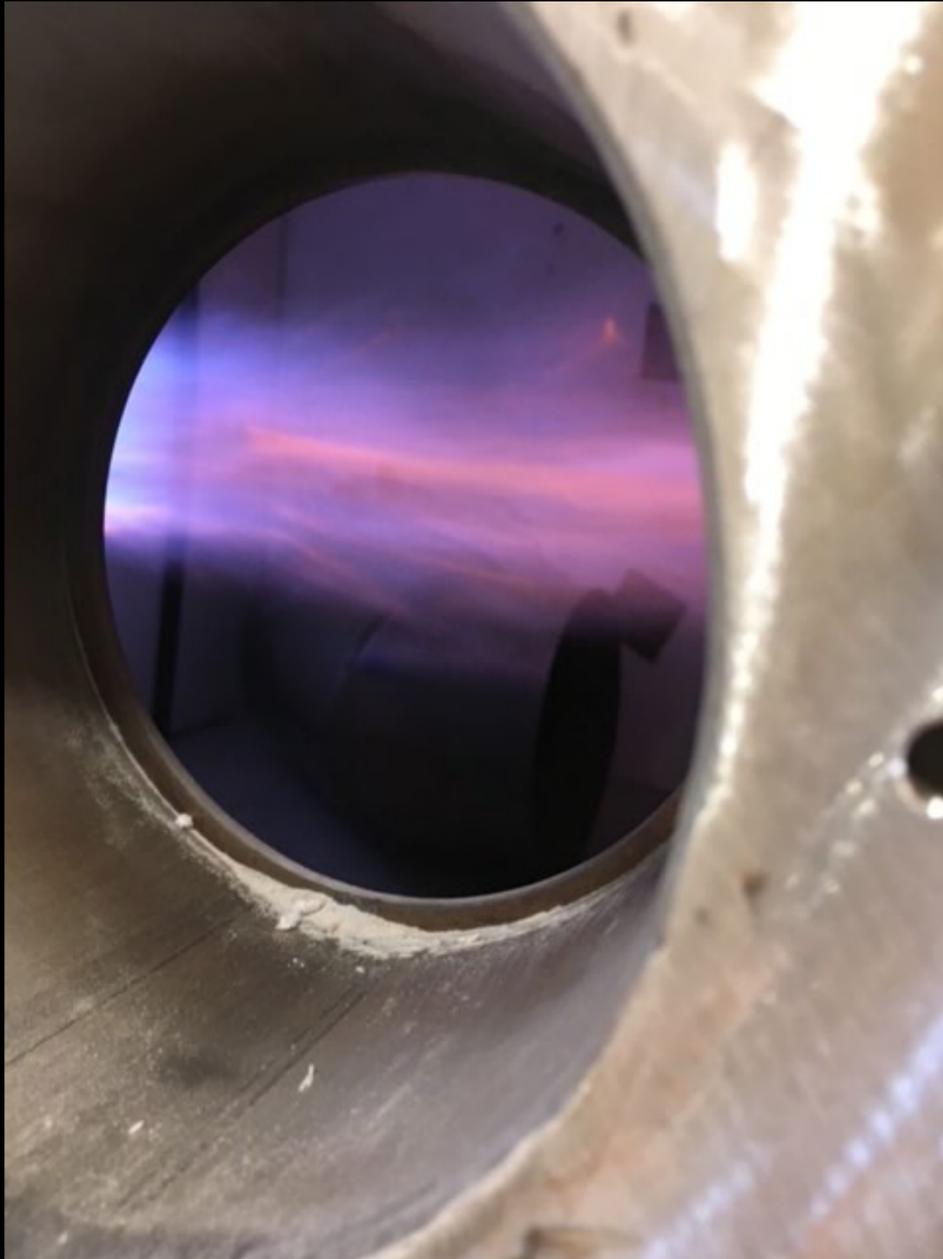
Load Test – Live – May 2022



Case: Sinagua Malt

3000 Mbtu/hr flame...

Steep Test – Live – May 2022



Case: Sinagua Malt

10000 gal of water

Steep Test – Live – May 2022



Case: Sinagua Malt

Full capacity

Tuning Recipes – Live



Case: Sinagua Malt

Storage and Clean



Case: Sinagua Malt

Fully Operational Sept 2023



Sinagua Malt / Alkemista IND

Sergio, Russel, Pete



Ofelia



Conclusions

01. High Demand job: Full-Stack Hw-Sw Engineer

02. The Value Cycle

03. Industrial Revolution and AI

04. Key Implementation Choices

05. 'Single Man Factory' – Case: SinaguaMalt Plant



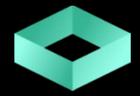
SINAGUA
MALT

Thank You

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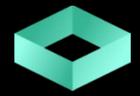


Alkemista IND.

A New Industrial Revolution

we have evolved to synthesize out of complex situations models that predict outcome - this is problem solving but it is motivated by our biological evolution. we can benefit from ai in helping the analysis of complex data to extract trends that can be modeled not by having ai replacing the model or driving the modeling - we can benefit from the data filtering ability that ai can bring not from inferring from that data a behavior. No decision making just data synthesis and simulations for operator driven scenarios.

instead of investing efforts in avoiding failure it is more efficient the partial degradation of the system while component is replaced - design for failure tolerance and rapid replacement



Alkemista IND.

A New Industrial Revolution

The new industrial revolution is a blend of ai and workforce designed to place the emphasis of decision making on the workforce while data filtering and data extraction on ai

the argument that ai learns as we do from recognizing patterns in the past and choosing the ones that turned into successes is not optimal - we can do better - we can model and synthesize to take advantage of rare occurring events that can advance understanding and generate the new and novel as opposed to ignore those events as outliers since they do not fit the trending patterns of the past.it

is hard to highlight the differences that innovation brings since it is a rare and fundamental human trait - it is easy to categorize it as a learning experience then use ai to replicate it - this does not make it valid - similarly leadership is predicated by a vision not by excellence in management

Next Industrial Revolution

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Innovation and AI

- AI generated results are comparable to rational developed models because we learn in similar ways ?
- it is hard to validate innovation as it is a rare and needs time in use.
- AI categorizes novelty as a learning experience but cannot replicate true innovation

