

LED Systems for Horticulture: Economics and Practice

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Project Purpose

- Market Analysis
 - Are LEDs commercially viable?
 - Two perspectives
 - Should you invest ?
 - What barriers exist for rapid adoption?
- Life Cycle Analysis
 - For a given system, what is the total life cycle impact?

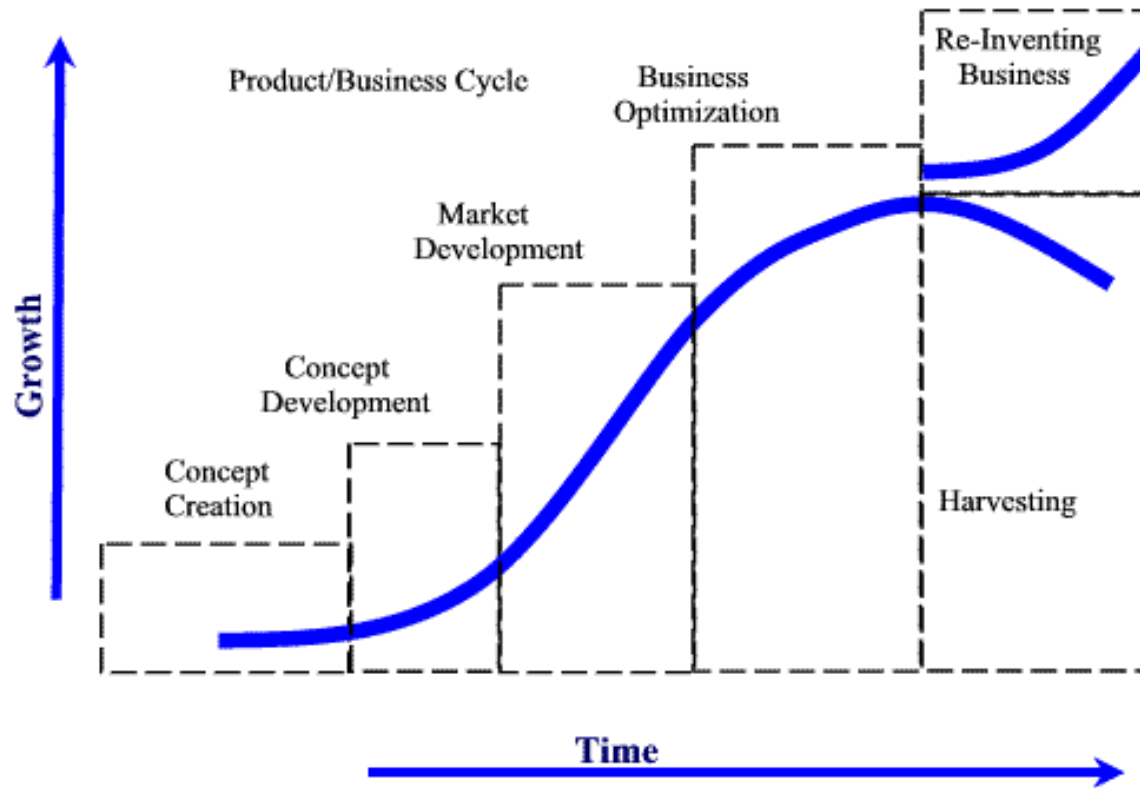


Market Analysis

- Can you & Should you?
- If so, in what applications?
 - Some applications will yield a higher return



How mature is this industry?



How mature is this industry?

- Multiple commercial products



- Lots of press trials and claims



Claims

- “The results of all the tests are impressive and the product is ready for the market. Growers can benefit from this.”
- “No less than 82% energy savings”
- “Reduce power and maintenance costs by half”



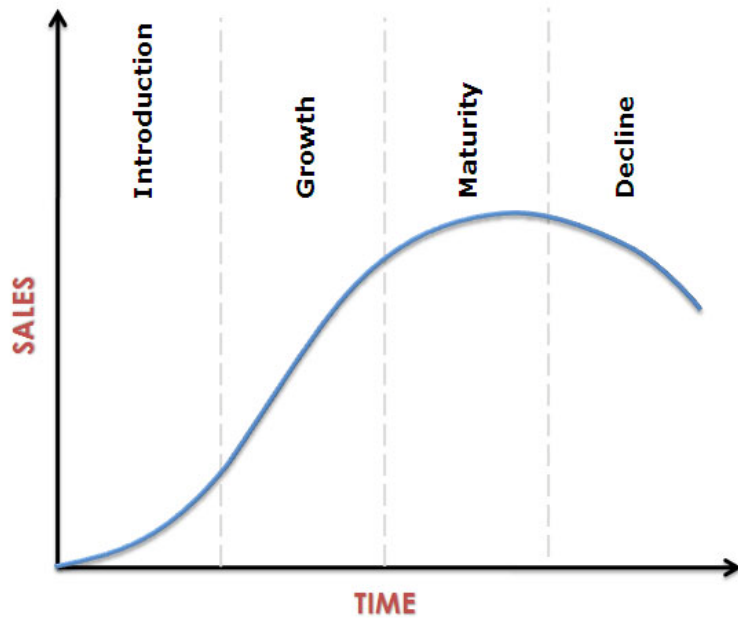
Still many unknowns

- What is the appropriate type of LED to use?
 - Air cooled, both active and passive
 - Water cooled
- What is the best design?
 - Bars, strips, bulbs, dense fixtures
 - Ratios of R/FR/B
- What is the proper usage?
 - Duration, Timing, Season, Application

(type) x (design) x (usage) = (# parameters)



How mature is this industry?



Adoption is governed by:

1. Perceived advantage
2. Risk factors
3. Ease of use
4. Timing of benefits
5. Observability
6. Trialability
7. Price
8. Fit with practices



Use, Trials and Fit with Practice

- Need to know what we should field test and why
- There will likely be a technology shakeout
 - In every industry dominant designs emerge
 - Punctuated equilibrium
 - Flip Phones, HD DVD and Blu Ray, etc
 - Current greenhouse practice well known
 - Current systems are costly
 - Benefits are risk adjusted
 - Hybrid?



Market Analysis : Stakeholder Role

Mitigation of economic and operational risk

- Relies on comparative studies – Traditional vs LED
 - How much power is consumed with current practice?
 - How do options compare in maintenance costs?
 - What other factors of production change (chemicals, water, heat, labor, etc)?
 - How much of your budget is in lighting?
 - Statistical significance vs economic significance (e.g two projects return 20% but one is \$1M capital, the other \$100K)



Market Analysis : Stakeholder Role

Mitigation of economic and operational risk

- Operational risk - the assurance that this will have a positive effect on yield
 - No “below the waterline” risks
- Also need to understand perception of risk
 - The higher the perceived risk, the more convincing the data must be

