SCALING UP OF RADIO MANUFACTURING

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VP SCM

TEJAS® NETWORKS

AGENDA

- Self Introduction
- Scaling up of Radio Manufacturing
- Journey
- Manufacturing facility video

ABOUT ME

- Vasantha Kumar
  - Vice President
  - Head of Manufacturing, Tejas Networks Limited
  - 3 Decades of experience in Radar, Radio and Telecommunication
  - Teaching, Radar maintenance and ops, verification, TAC, documentation, training, homologation, system engineering, sales, manufacturing
  - Worked for SJCE, Indian Air Force, Infosys, Reliance

SCALING OF MANUFACTURING

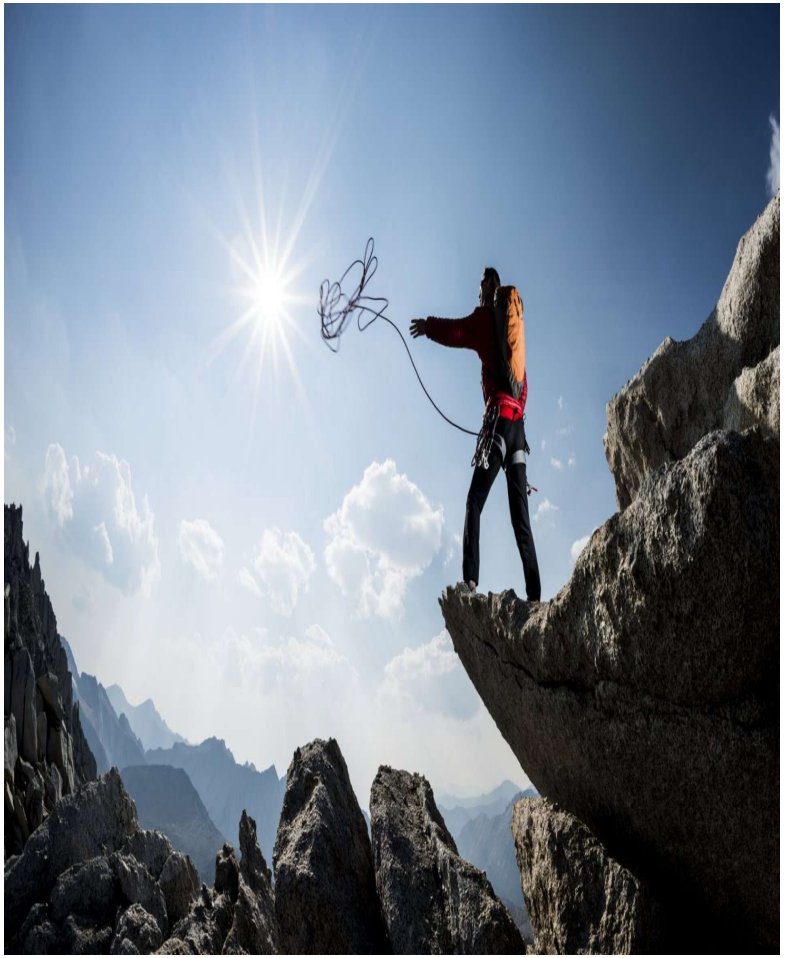
- What is the scale
- Why is it a challenge
- Isn’t it a trivial issue

SCALE

- We did 200 radios production in two months
- Ask was to produce 45,000 radios in a month
- Ask was to produce 1500 to 3000 radios production per day
  - To take care of variations in raw material supply

CHALLENGES IN SCALING

- To start with production quantity was large
- Radio manufacturing is different from any other product as even a small piece of hair acts as transmitter affecting throughput
- Different components of production posed unique challenges
  - Giant heat sink (15Kg)
  - Power Amplifier card
  - Challenges with respect to solder paste voids



TRIVIAL? NO!!!

- If you are planning to ship 10 systems and 1 does not make it, you can put a night out and produce another one or keep a buffer of 10%
- 1000s of radios, each needing appox
  - 20+ cards
  - 50K+ components
- One part can stop the whole shipment, capacity lost cannot be recovered
- RF needs skilled manpower
  - We need them quickly and for only specific period
- Process need to be enhanced for smooth flow, very less issues
- Infrastructure has to be built for bulk manufacturing and scaling down

OVERCOMING CHALLENGES

- People
- Process
- Material
- Infrastructure

PEOPLE

- Status
  - We started design couple of years back and have working products in field
  - Now we need to manufacture and ship
  - New technology, we got support from Design team and used telecom production crew to produce the first lot of 200 radios
- Requirement
  - Need crew to produce 3000 radios per day
  - Let them go once we complete project
  - Needed 1200+ people for direct working
  - 300+ for indirect (management, inventory support) etc

PEOPLE

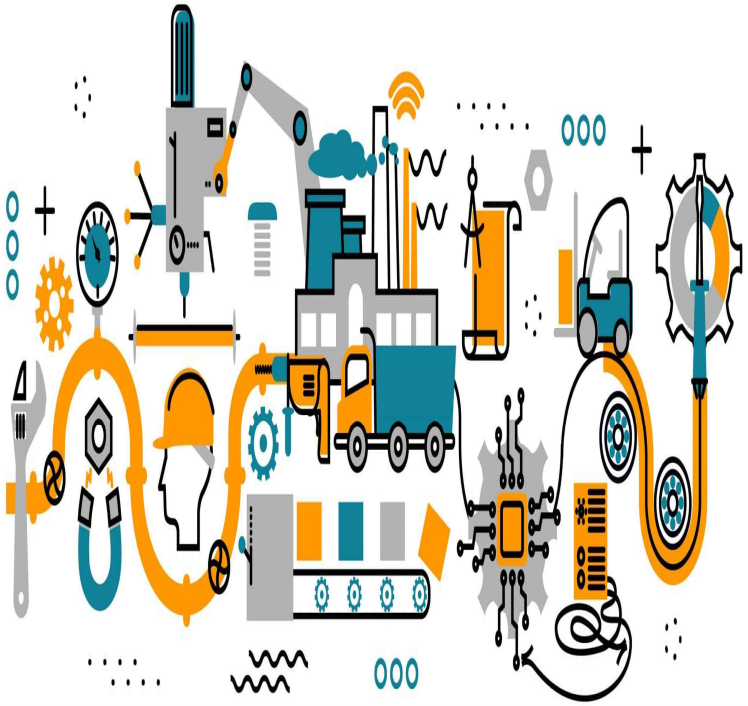
- Solution
  - Leadership team selected from existing employees
  - Scouted the market for companies that can supply large manpower for fixed duration
  - Shortlisted 2 in less than a month
  - Started dedicated interview lines, which used to run from Monday morning till Sunday evening
  - People had to double up as workers during regular shift and as interviewers after that
  - We prepared training program to get new recruits to speed
  - Used Mentor-mentee program to get them to line

PEOPLE

- Teething problems/solutions
  - Finally we got them into assembly line but
  - The yield went to 50-60% due to skillset issues
    - Go No Go loop built to convert faulty inventory
    - Daily gemba meeting to to create “Do it right first time, everytime”
    - Put in systems that are idiot proof
  - Then came attrition, conflicts
    - Counseling, soft skills training
    - Awards to recognize heros around team
- Finally after a month things settled down
- Motivation for hard work ahead
  - Pep talk
  - Management interaction
  - Team building events

PROCESS

- Status
  - High mix low volume production
  - Manual Data capture
  - Manual Testing
  - Radio Assembly
    - Issues with respect to thermal adhesive
    - Connecting plate
    - Multiple version of cards
    - Issues in assembly (RF bullet, serial cable, labeling)
  - Testing
    - Manual testing
    - RF chamber Vs Box
    - User equipment variations
    - EPC server
    - RF interference
    - Multiple software versions
    - EPROM programming



MANUFACTURING

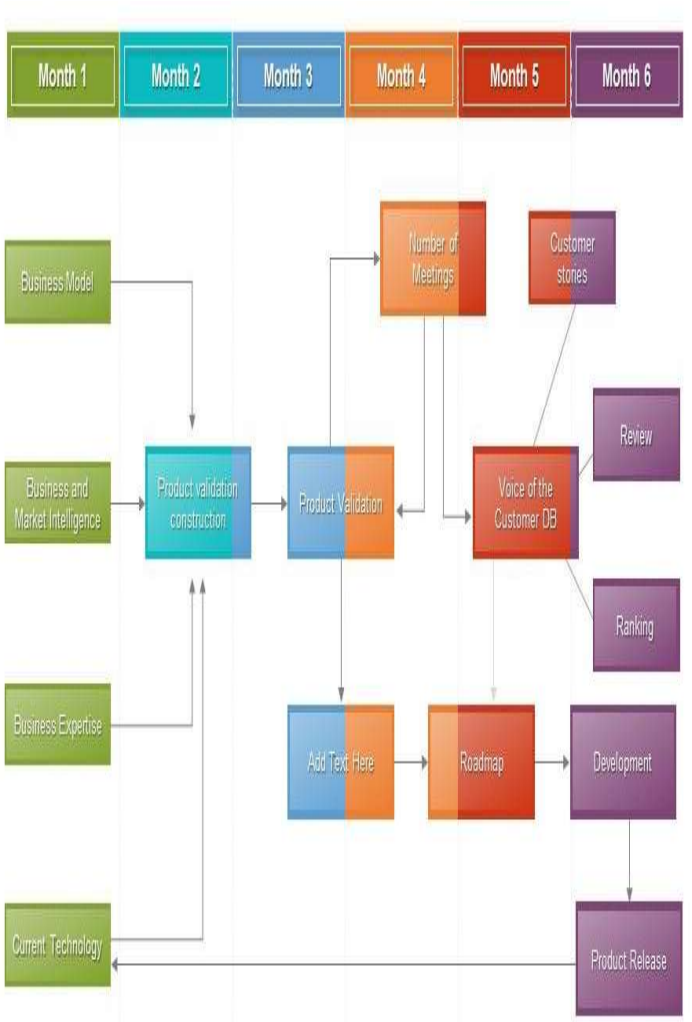
PROCESS

- Packing
  - Missing material
  - Transient damage

- Logistics
  - Material acceptance issues
  - Changes in destination
  - Clearance delay in shipment

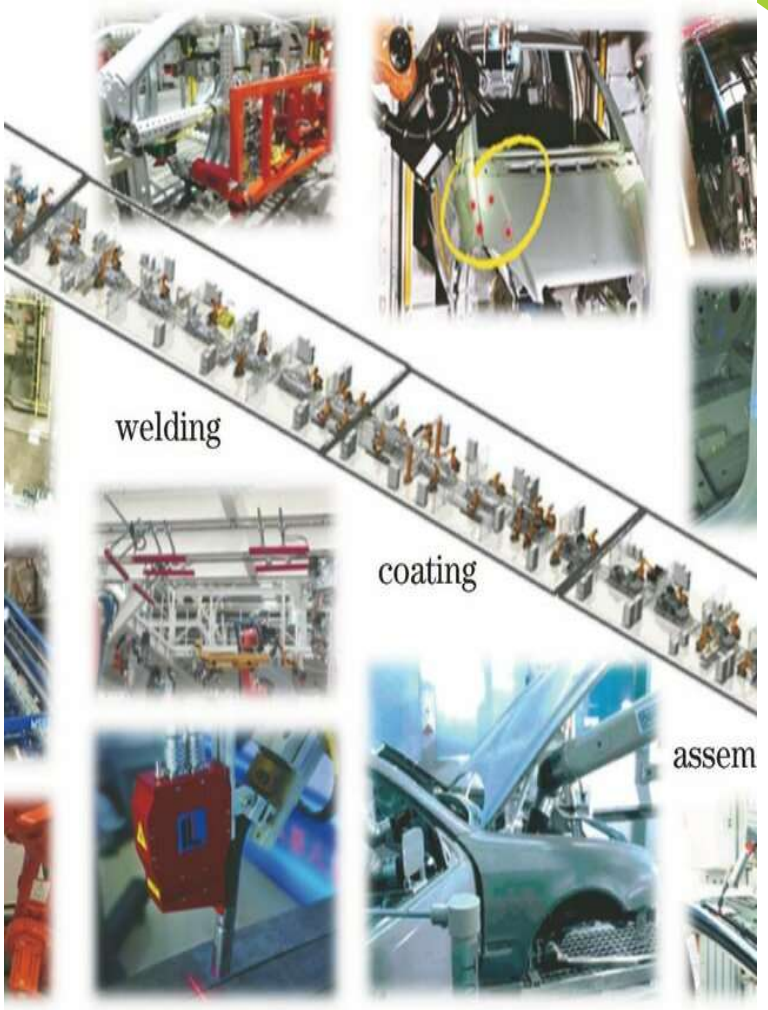
PROCESS

- Requirement
  - Low mix high volume production
  - Automatic data capture and easy retrieval
  - Automation of customer test plan and report requirement
- Solution
  - Radio Assembly
    - Automatic thermal material dispense
    - Regular IQA of connection plate, version control
    - Test strategy of multiple versions of cards in advance
    - Repeated training and dedicated debug line to eliminate issues in assembly



PROCESS

- Solution
  - Testing
    - Automation of test and report generation
    - Design of new layout
    - Dedicated IE and tests automation team to resolve all issues related to UPH and test challenges
  - In process quality control



PROCESS

- Packing
  - Ware house management system
  - OBA process for review of material before packing
  - MES
  - Enhancement of packing to reduce/eliminate transient damage

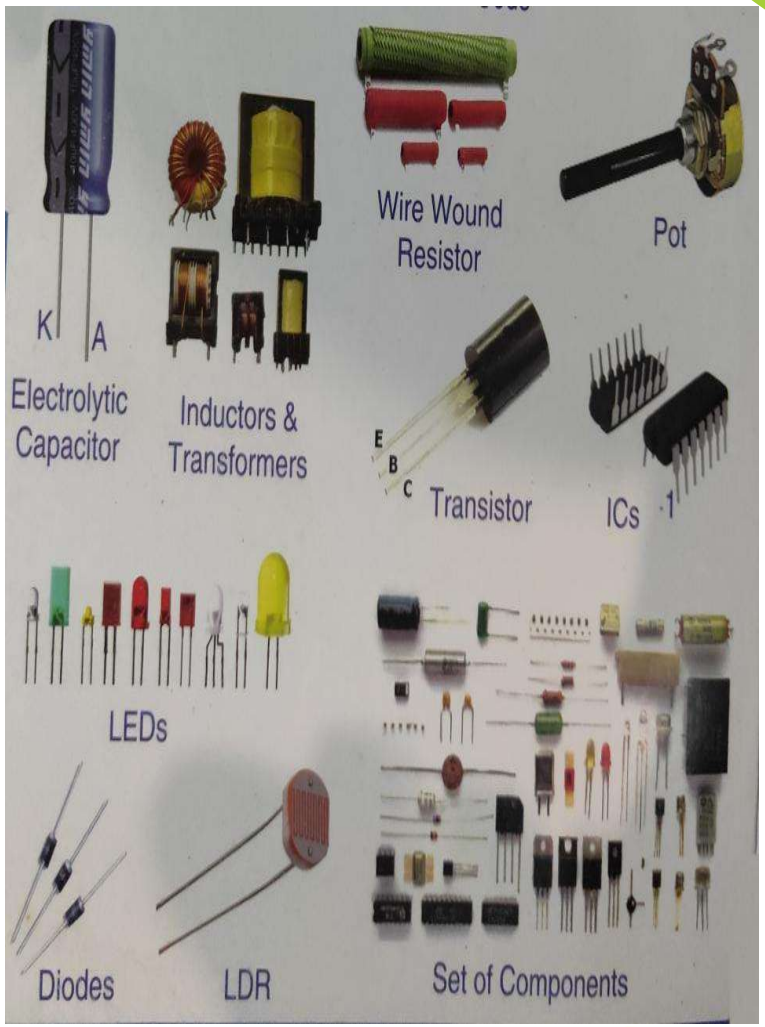
- Logistics
  - Transport Management system
  - Program management team to handle
    - Material acceptance issues
    - Changes in destination
    - Clearance delay in shipment

MATERIAL

- Status
  - Material planning
    - MRP tool run
  - Accuracy concern
  - Time to react was tight
  - Production challenges PCBA
    - Power Amplifier
    - Copper coin alignment
    - Void in solder paste
    - Component drift during reflow
    - Heat sink dislodging BGA
  - Production challenges mechanicals
    - Diecasting
    - Blocking
    - Fin breaking
    - Powder coating
    - Helicoil spring

MATERIAL

- Requirement
  - Accurate planning
  - JIT or at least a weekly accurate raw material availability
- Solution
  - Material Planning
    - ERP enhancement
    - MES
    - Manual planning review (twice a day, 6days a week)
    - Alternate designs
- EMS issue resolutions
  - Robust NPI program for EMS
  - Creation of Process support team
  - Multiple trials
  - Regular review and recovery
  - X ray, void % measurement
  - Controlled SMT process, closed monitoring
  - Vertical positioning, nitrogen in reflow
  - Edge bonding

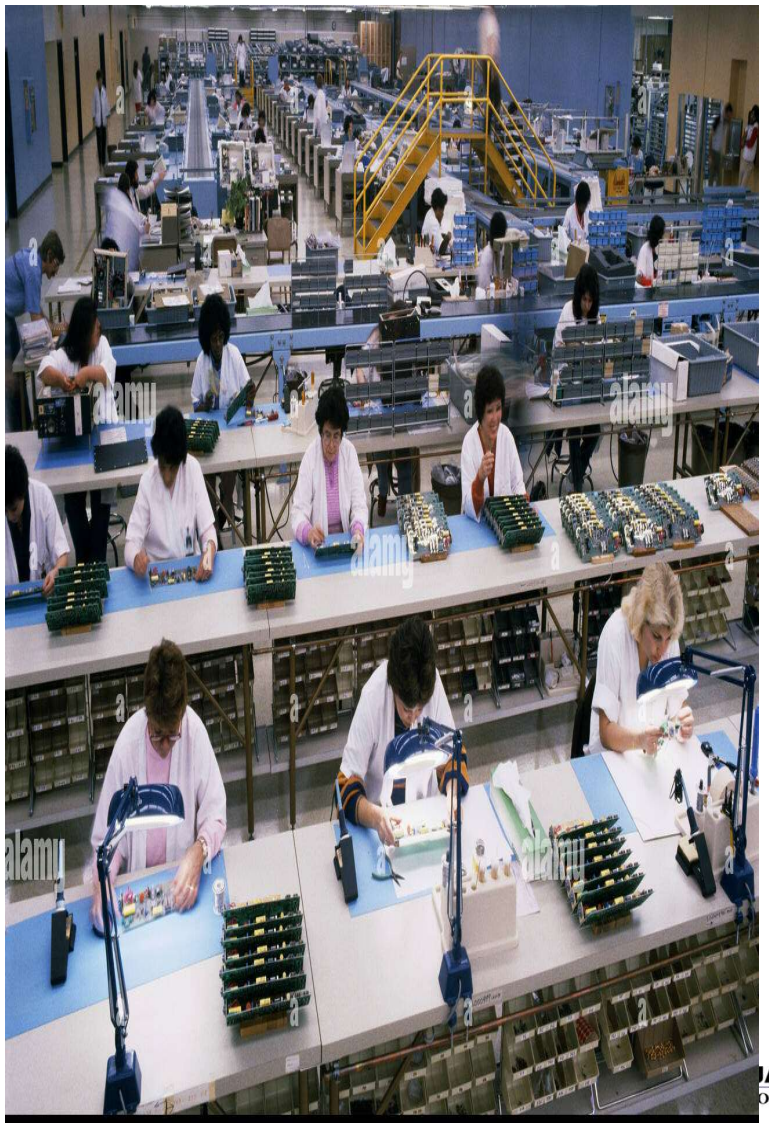


MATERIAL

- Solution
  - Chassis production
    - Dedicated team monitoring die cast production
    - Daily review of production status
    - Regular visits to vendor location
    - Audits by Industry Experts
    - International solution

INFRASTRUCTURE

- Status
  - High mix low volume, process layout
- Requirement
  - Need to build low mix high volume assembly line
- Solution
  - Hired Industrial Engineering team
  - Assembly lines built based on
    - Material flow analysis
    - Cycle time analysis
    - Idle time elimination
  - X-ray counter for component counting

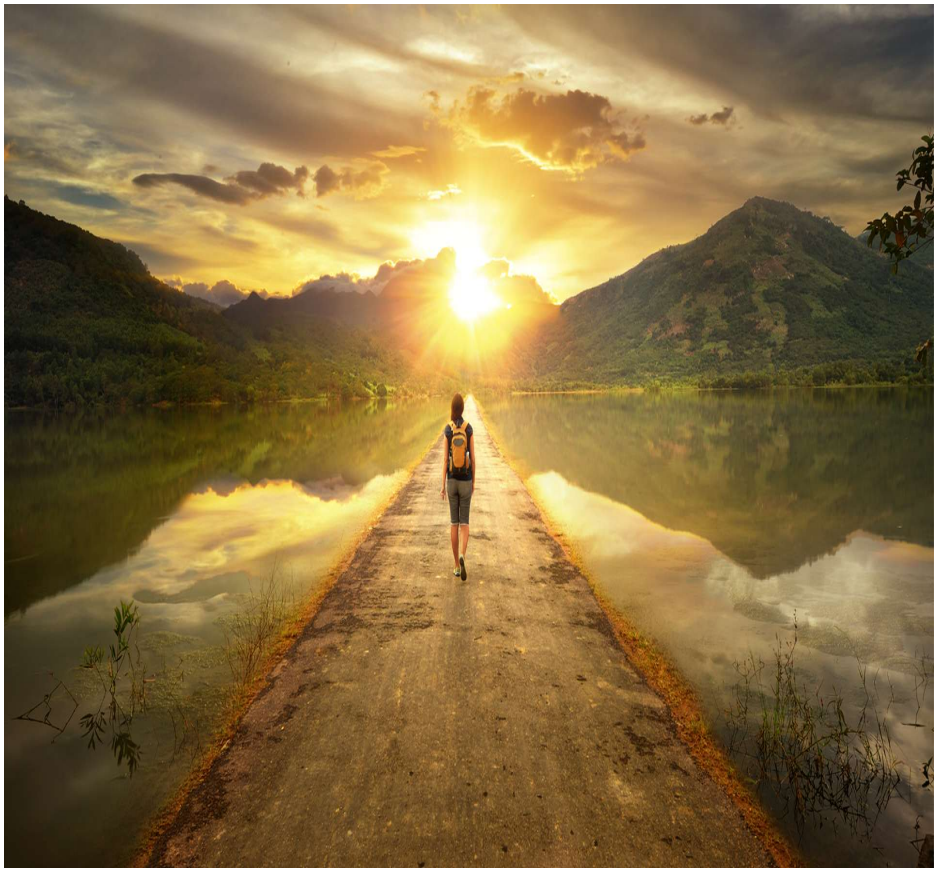


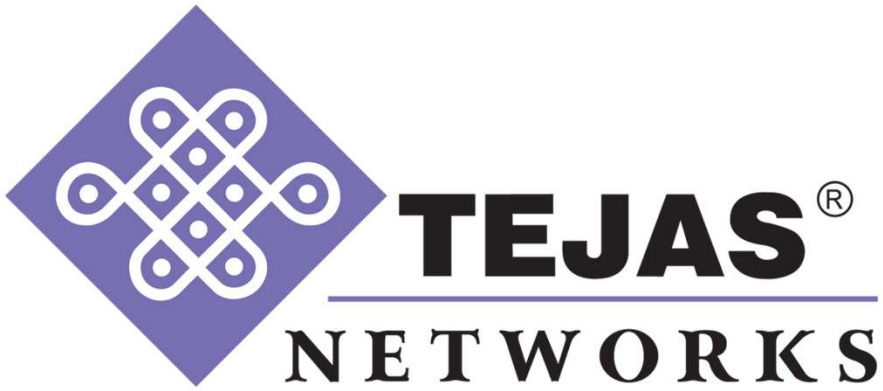
INFRASTRUCTURE

- Additional facility built in house
  - Manufacturing lines
  - Warehouse space
  - Thermal chambers
  - RF boxes
  - Material lifts
  - Automatic dispensers
  - Gravity based rollers
- Develop infra outside
  - Partner addition
  - Production across multiple locations in India
  - Customer approval of these infra

JOURNEY

- If you decide and put right focus you can achieve anything you want to
- Challenges creates heroes
- We started of with NPI by producing 200 radios in 2 months
- In terms of daily capacity we reached 3000 radios per day in 18 months
- We reached
  - 4500 in 9 months
  - 15000 in 10 months
  - 22,500 in 15 months
  - 48,000 in 18 months
- Developed training scheme to convert fresher to work in line within 4 working days
- Now working on scaling down ☹





Thank you!

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