Research lead Leo Ducrot will present the results of an extensive study on DDMRP from the Massachusetts Institute of Technology (M.I.T.). The project investigated how Demand Driven MRP (DDMRP) operates in a capacity constrained environment. Using qualitative and quantitative analysis, the study proves that DDMRP increases service levels and reduces both inventory levels and customer order lead times.
Can DDMRP be a game-changer in supply chain planning?
Sponsors of the project: avoiding bias

Advanced planning solution provider

Institute developing and promoting DDMRP

Industrial partner (investigating DDMRP)
Motivation: Can DDMRP be a game changer?

DDMRP average result:

-20% inventory
13% service level
-48% leadtime reduction

Can these numbers be achieved in all industries?
Motivation: Can DDMRP be a game changer?

Financial impact:

- inventory
- service level
- leadtime reduction
- ROI
Could that work in my company?
What does the literature say about it?

Current literature available

MRP 1965

APS 1990’s

DDMRP 2011

Project scope

PhD thesis
Developing the research question

**DDMRP** Leverage decoupling points to make the planning problem easier!
Can DDMRP handle constraints that MRP does not handle well?

DDMRP uses decoupled points to create a more stable and suitable environment for MRP. Would that bring better results than an APS?

Research Question: What would be the added value of DDMRP in finite capacity planning under uncertainty?
Methodology

**Qualitative/Quantitative part**: What was the impact of DDMRP on companies that implemented it?

- **Interviews**: A few companies, in-depth investigation
- **Survey**: Many companies, targeted questions

**Simulation analysis**: Let’s compare KPIs of plans made with APS and DDMRP

- **Simulation**: Comparing APS and DDMRP in a controlled environment

- **Inventory turn**
- **Service Level**
This must only work for small companies...
Application of DDMRP, size does not matter...

<table>
<thead>
<tr>
<th>Annual revenues</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= $100 M</td>
<td>17%</td>
</tr>
<tr>
<td>&gt; $100M &lt;= $500M</td>
<td>46%</td>
</tr>
<tr>
<td>&gt; $10 B</td>
<td>29%</td>
</tr>
</tbody>
</table>
But I already have a better system than MRP!
APS do better than MRP, but DDMRP still brings value

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>MRP</th>
<th>APS</th>
</tr>
</thead>
<tbody>
<tr>
<td>service level</td>
<td>13%</td>
<td>23%</td>
<td>7%</td>
</tr>
<tr>
<td>inventory</td>
<td>-20%</td>
<td>-23%</td>
<td>-13%</td>
</tr>
<tr>
<td>Customer lead time</td>
<td>-48%</td>
<td>-55%</td>
<td>-26%</td>
</tr>
</tbody>
</table>
Wait a minute, what was their maturity level in planning?
DDMRP brings maturity to the next level

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>23%</th>
<th>6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service level</td>
<td>13%</td>
<td>23%</td>
<td>6%</td>
</tr>
<tr>
<td>Inventory</td>
<td>-20%</td>
<td>-22%</td>
<td>-16%</td>
</tr>
<tr>
<td>Customer lead time</td>
<td>-48%</td>
<td>-47%</td>
<td>-29%</td>
</tr>
</tbody>
</table>
It looks like it is applied everywhere!
Can DDMRP handle my operational constraints?
## Sourcing decisions is not the strength of DDMRP

<table>
<thead>
<tr>
<th>Sourcing decision</th>
<th>All respondents</th>
<th>Respondents with sourcing decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderately Effective</td>
<td>27%</td>
<td>38%</td>
</tr>
<tr>
<td>Effective</td>
<td>54%</td>
<td>46%</td>
</tr>
</tbody>
</table>
DDMRP can manage shelf-life limitations

<table>
<thead>
<tr>
<th>Shelf-life Constraint</th>
<th>All respondents</th>
<th>Respondents with shelf-life limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderately</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>Effective</td>
<td>45%</td>
</tr>
</tbody>
</table>
DDMRP works at finite capacity

<table>
<thead>
<tr>
<th>Capacity Constraint</th>
<th>All respondents</th>
<th>Capacity constraints respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderately Effective</td>
<td>15%</td>
<td>18%</td>
</tr>
<tr>
<td>Effective</td>
<td>58%</td>
<td>73%</td>
</tr>
</tbody>
</table>
Simulation results when forecast accuracy is low (65%)

DDMRP outperforms the heuristic-based planning

Results are similar to the solver

DDMRP is more robust to capacity constraint than the heuristic

The solver is overall more robust
Simulation results when operations are highly variable

DDMRP outperforms the heuristic-based planning

Results are similar to the solver

The solver is overall more robust
# Trade-offs between DDMRP and traditional planning

<table>
<thead>
<tr>
<th></th>
<th>APS heuristic</th>
<th>APS solver</th>
<th>DDMRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient use of inventory</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Easy to understand</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Easy to maintain</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Non-trivial solutions</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Advanced Operational constraints</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>
Beyond service level and inventory

Improvements in the operations with DDMRP

- Planning Stability
- Clear priorities
- Better control over the operations
- Smoother dependent requirements
- Relevant information

- Agree
- Neither Agree nor Disagree
- Disagree
- Cannot Say
DDMRP streamlines operations

Education program across the company
Educate everyone on the basic of flow
Align objectives

DDMRP implementations lead to streamlined operations across the internal supply chain
It seems like DDMRP can handle complex operational constraints!
What is the added value of DDMRP?

Easy planning method that can have a positive financial impact and provides a competitive edge

Provides results similar to a mathematical solver

Streamline the operations
Do you have any question?

lducrot@mit.edu
eahmed@mit.edu
Problem setting: DDMRP planning principles

Order book

Cumulative leadtime

Long time future

Only use Customer order

Quantity to replenish

Set up buffers according to anticipated future

Adapt the system (Portfolio, capacity, buy-make) to the desired future

Use forecasts
Methodology

**Qualitative/ Quantitative part:** What was the impact of DDMRP on companies that implemented it?

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[Graph showing inventory turn vs. service level]
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Financial impact:

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