A DFMA Cost Information Management System at Whirlpool

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Presentation Outline

- Overview of the Competitive Cost Analysis Team in China
- Internal Pressures
- Responses
- DFMA Manager Technical Solution Overview
- Lessons Learned & Benefits

Competitive Cost Analysis (CCA) Group

- Charter – Develop & Standardize a competitive comparison method that is repeatable and reliable
- DFMA is the foundation of this process
  - DFA is used for labor estimates and BOM
  - DFM is used for Cost Modeling with custom libraries
  - Process standardized, documented and communicated
- Principal customers
  - Engineering
    - Existing product comparisons (cost gap, materials used, design solutions)
    - New product development (value optimization, market comparison)
  - Procurement
    - Current spend analysis (Model to PO comparison)
    - Target Costing input (identification & setting)

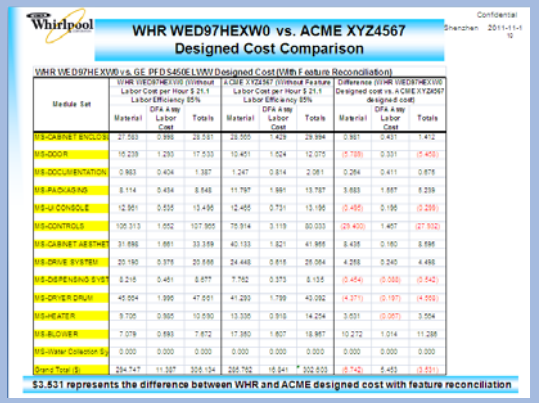
CCA is the global teardown & analysis group based in China

- Started in 2008
- From 6 to 64 people
- From 10 to 212 reports / yr
- Average $10/unit in savings ideas per report
- $15M in procurement spend analysis savings in 2011

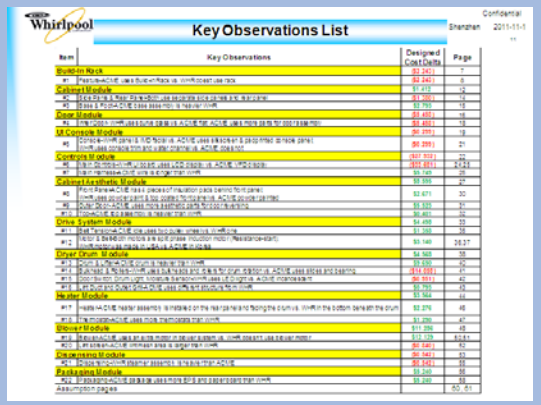
Competitive Cost Analysis Reports

--Report Overview--

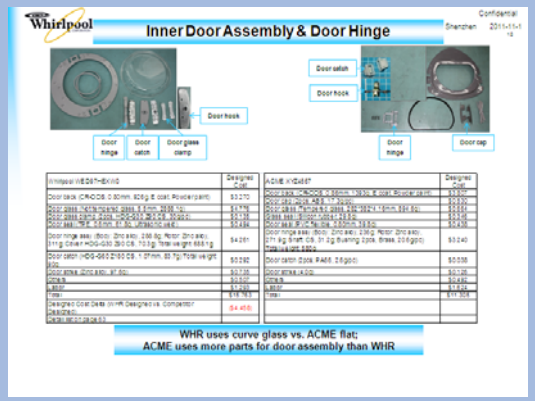
Sub-System Cost Gaps



Observations



Pictures with Cost Details



--Report Complexity--

High Volume

- More than 200 reports / year
- 2500 files / ~2GB of data per report
- Global customers, 12 design centers
- Increasing customer requests for additional data.

Varied Use Cases

- Driving design teams
- Leveraged by purchasing
- Incorporated in launch efforts
- Utilized by Cost Reduction teams

Changing Environment

- Rapid cost input changes
- Increasing modeling by other teams
- Increasing use cases
- Pushed to the limits of productivity

Challenges in path to increased user access and accuracy

Goals – Manage access and updating of existing CCA data

- Report and file access is limiting
  - Prior managed distribution system. Need global access
  - Quantity and size of files make search difficult
- Manual updating process is too burdensome
  - Users can not compare cost results across reports because of different libraries in each comparison.
  - Process takes the same amount of time to update past analysis to today's cost libraries
- Whirlpool wanted to leverage existing technologies: DFMA, DFR and Windchill PLM. No other solution met their needs.
  - DFMA – BDI costing tools
  - DFR – Whirlpool's database of classified part metadata
  - Windchill – Whirlpool's new PDM system

Its like comparing "apples to oranges" if your library inputs are different

“DFMA Manager Tool” addresses many pain points

--Issue Summary--

- Reduce cost modeling and file errors as activity increases and new hires come onboard.
- Reduce manual effort and time of assembling reports to customers
- Reduce the effort required to refresh packages of DFMA models for internal customers
- Reduce the number of errors tied to input cost libraries
- Reduce time spent duplicating cost models already in existence

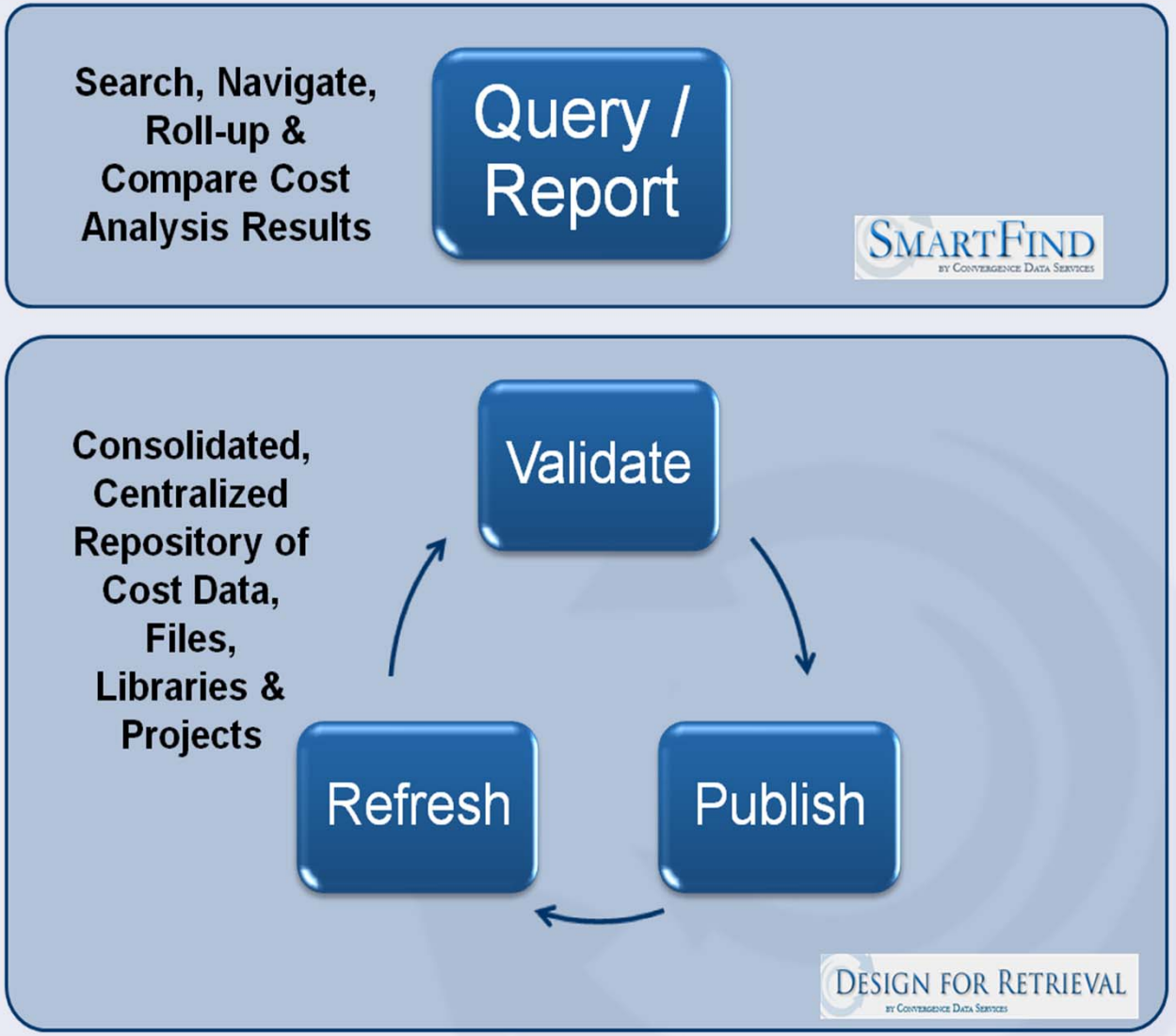
--Technology Response*--

- Automated DFMA **model validation** and error reporting
- DFMA **report publisher** to package up libraries, files, and DFMA data
- DFMA **automated model refresh** capability to update models with new input data
- DFMA **library management** standardizes usage and refresh
- **Search capability** to enable model reuse whenever possible

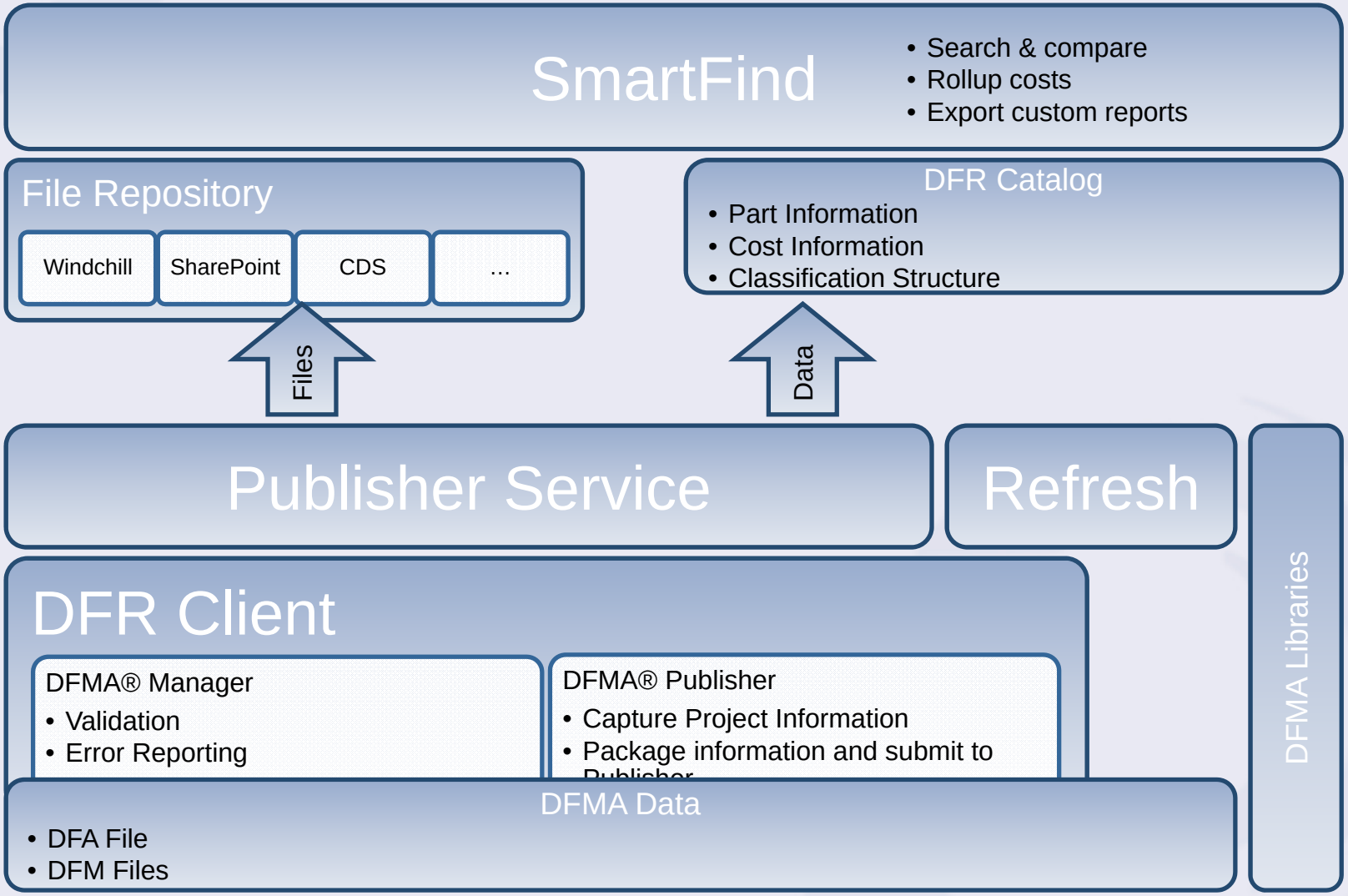
*Other responses beyond technology include RACI, process, KPI’s, and others

CDS DFR / DFMA Integration Solution Capabilities – Augmenting the Parts Catalog

- Creates and Maintains a Consolidated, Centralized Repository of DFMA Data, Files, Libraries, & Projects
  - Validates DFMA® data and files
  - Publishes data, files and libraries in a centralized database
  - Enables automated refreshes of DFMA® data against selected DFMA libraries
- Provides Analytical Query, Search, and Reporting Tools
  - Should-Cost Reports
  - Cost Comparisons
  - Cost Roll-ups



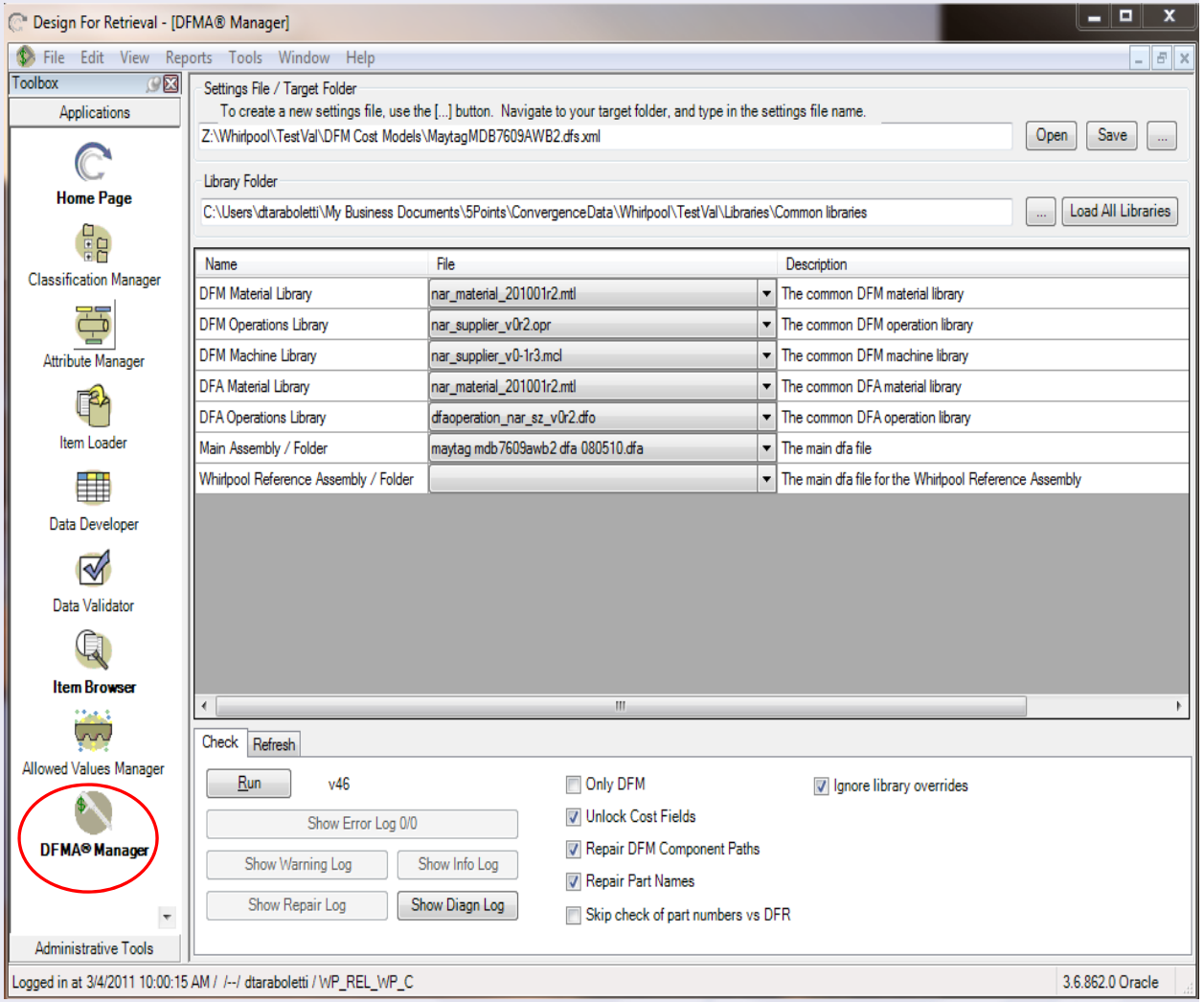
Technical Solution Architecture



Validate

The DFMA ® Manager Validation establishes and enforces standardization of DFMA analyses across the enterprise.

- Validations ensure DFMA ® files are correct prior to publishing
  - Checks for missing data and ensures all required information is provided, e.g. part numbers, weights, etc.
  - Ensures better quality data will be available for analysis and that comparisons will be enabled
- Provides a diagnostic report for errors found
- Repairs data issues



Validate

Examples of DFMA Manager Validation Checks

- Assures that the DFM component files referenced by the DFA files are present
- Conducts validations on DFM parts and DFA model subassemblies
- Verifies the DFMA® version last used to calculate cost
- Verifies that materials, machines, and operations referenced by the DFMA® files are present in the referenced libraries
- Currently over 60 validation checks are done (see examples)

Sample DFMA® Validation Checks

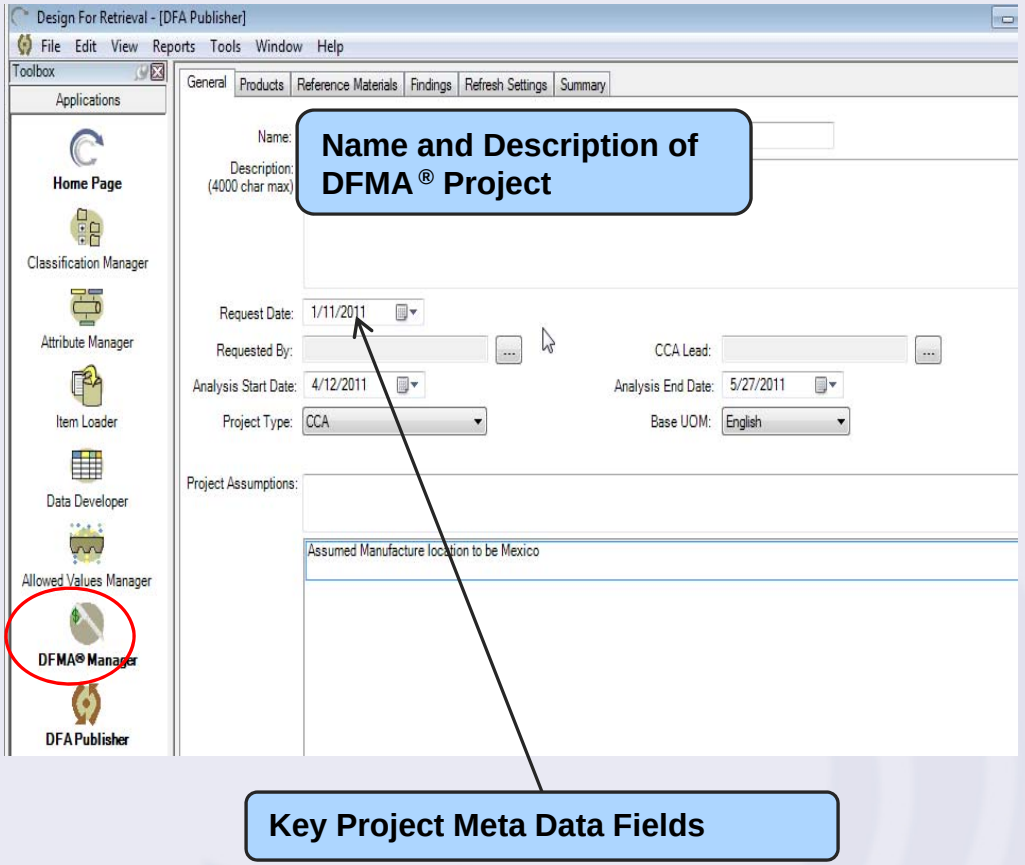
Exception Level	Exception Code	Exception Note
Error	PNMiss	No part number specified for part name: {part name} – {file name}
Error	NoPrtSpec	No part number specified, name: {Part Number}. Is it an operation?
Error	NoVarData	No variable data for: {item}-{variable}
Error	PartMultFiles	Part: {item number} is defined in multiple files:{file names}
Error	PartMultFilesUsing	Part: {Part Number} is defined in multiple files:{file name 1}, {filename 2}…
Error	WpXrefNotFnd	The comparable equivalent part {cross-reference part number} in {part number} does not exist in the referenced teardown
Error	WpXrefBlank	The equivalent comparable part in {competitor part number} is blank
Error	LckCostFld	The following refresh-managed attributes were edited/overridden by the user:{user id}
Error	PNMissDFM	The part number: {part number} is not in the DFM database
Error	TDFldMiss	The teardown code field is missing

Helps to standardize your DFMA® Modeling Practices

Publish

The DFMA Publisher bundles DFMA Data, Files and Libraries into a centralized, consolidated repository.

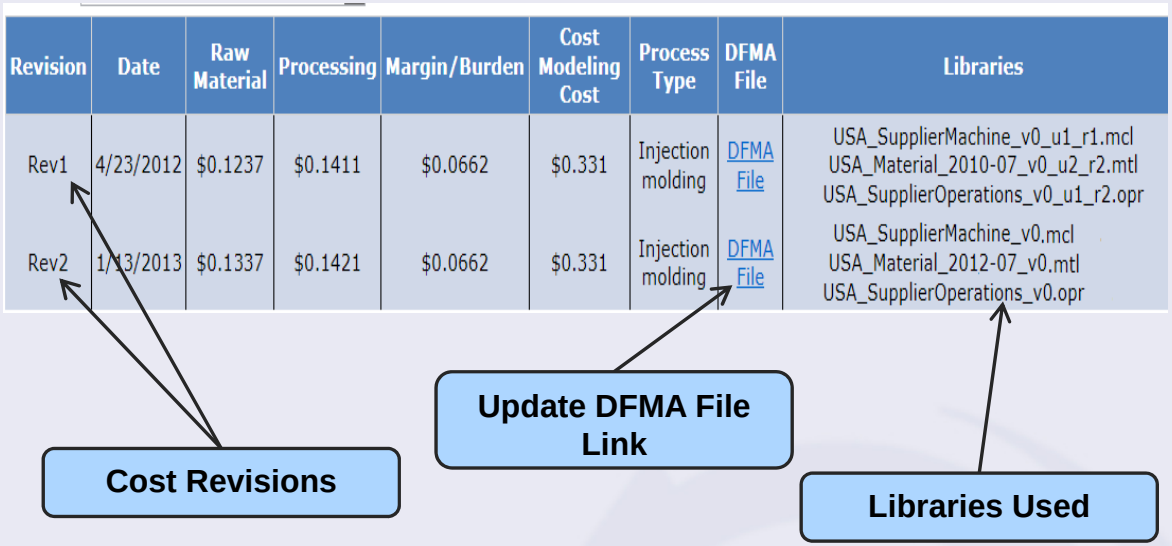
- Captures key meta-data and related artifacts
  - Creates “Projects” that includes multiple DFMA® analyses for roll-up or comparison at multiple levels e.g. Product, Sub-system, Module, Component
  - Indexes DFMA® files with legacy document vault(s) or network drives
  - Links related reference material, e.g. summary reports, etc., associated with a DFMA® analysis
- Establishes a Refresh Schedule
  - Enables automated, periodic checks against selected Libraries for revisions which would in-turn drive the need for DFMA refresh



Refresh

Refresh capabilities ensure the effective reuse and update of DFMA Analysis assets with the most relevant, up-to-date costs.

- Users can manually select projects for refresh, or set automatic refresh schedules in the DFA Publisher
- Refresh triggers use of the latest DFMA libraries, e.g. with updated materials pricing, for the correct region (e.g. China, India, South America, etc.) based on user's selected region
- Upon completion of a Refresh, the new cost data is Published to the repository and user notifications are sent
- The Revision History of costs and related DFM/DFA files are maintained in the repository



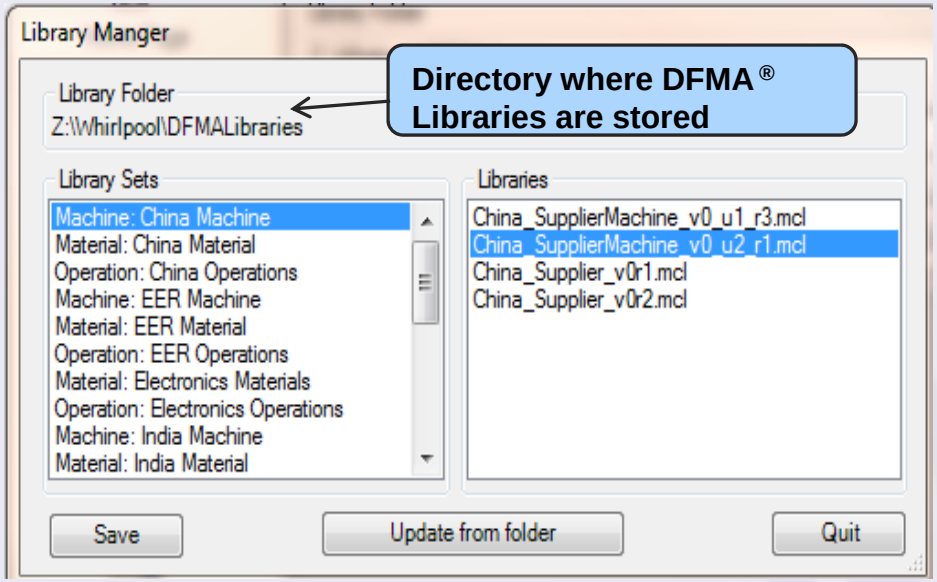
Revision	Date	Raw Material	Processing	Margin/Burden	Cost Modeling Cost	Process Type	DFMA File	Libraries
Rev1	4/23/2012	$0.1237	$0.1411	$0.0662	$0.331	Injection molding	DFMA File	USA_SupplierMachine_v0_u1_r1.mcl USA_Material_2010-07_v0_u2_r2.mtl USA_SupplierOperations_v0_u1_r2.opr
Rev2	1/13/2013	$0.1337	$0.1421	$0.0662	$0.331	Injection molding	DFMA File	USA_SupplierMachine_v0.mcl USA_Material_2012-07_v0.mtl USA_SupplierOperations_v0.opr

Refresh

DFMA® Library Management provides coordination of Dynamic and Complex enterprise-wide Cost Libraries.

- Dynamic Library revisions drive the need for provided Refresh Management capabilities
  - DFMA Manager dynamically recognizes the need for analysis refresh based on Library obsolescence
- DFMA Manager reduces extended enterprise complexity through management of Libraries across various criteria such as by Region of Origin
  - Machines
  - Materials
  - Operations
- DFMA Manager maintains Historical Revisions of cost libraries

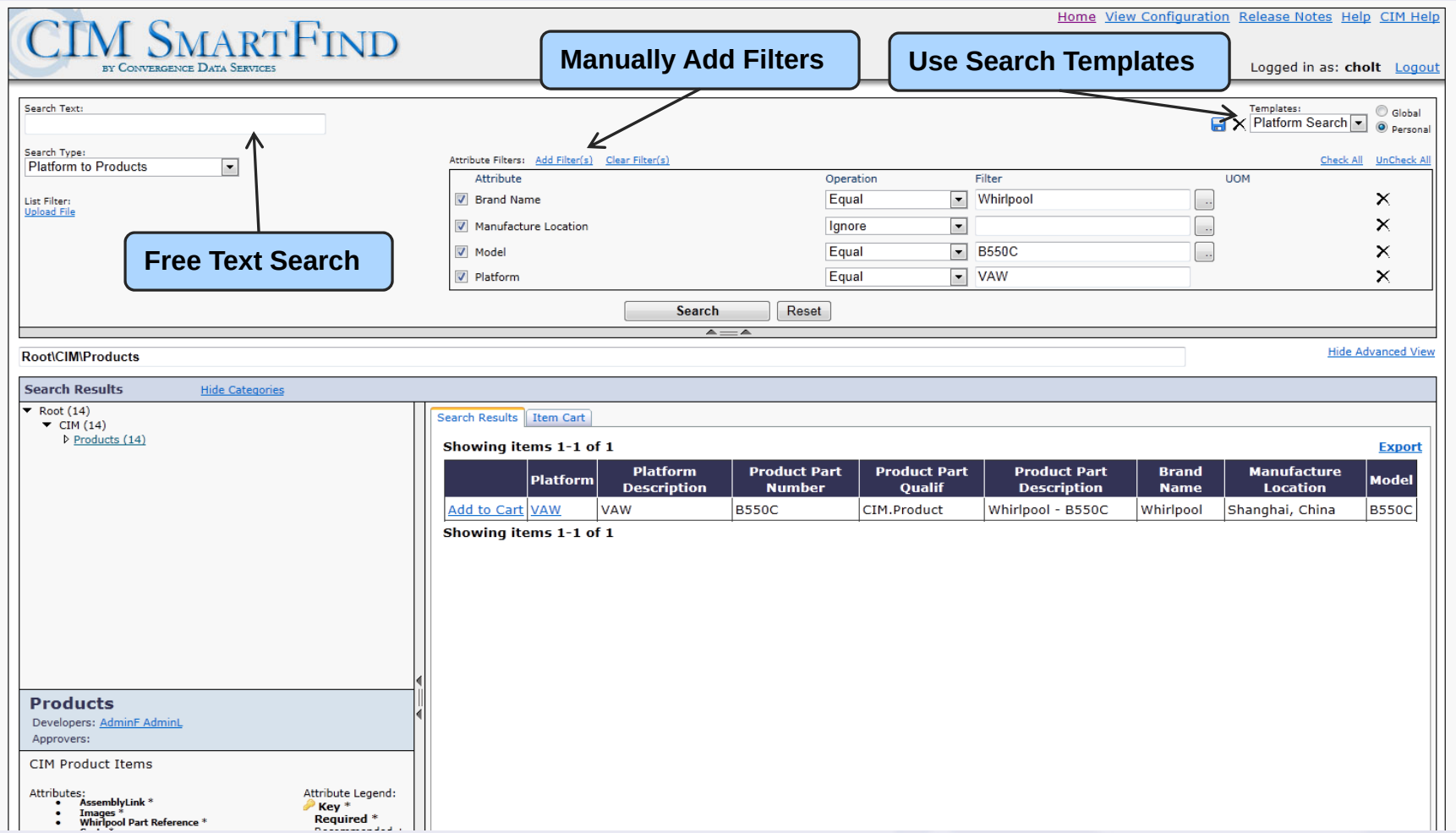
Example of Managing DFMA® Libraries by Region



Query/ Report

CDS' SmartFind Search tool provides Search, Compare, Navigate and Rollup of DFMA ® Should-cost Data.

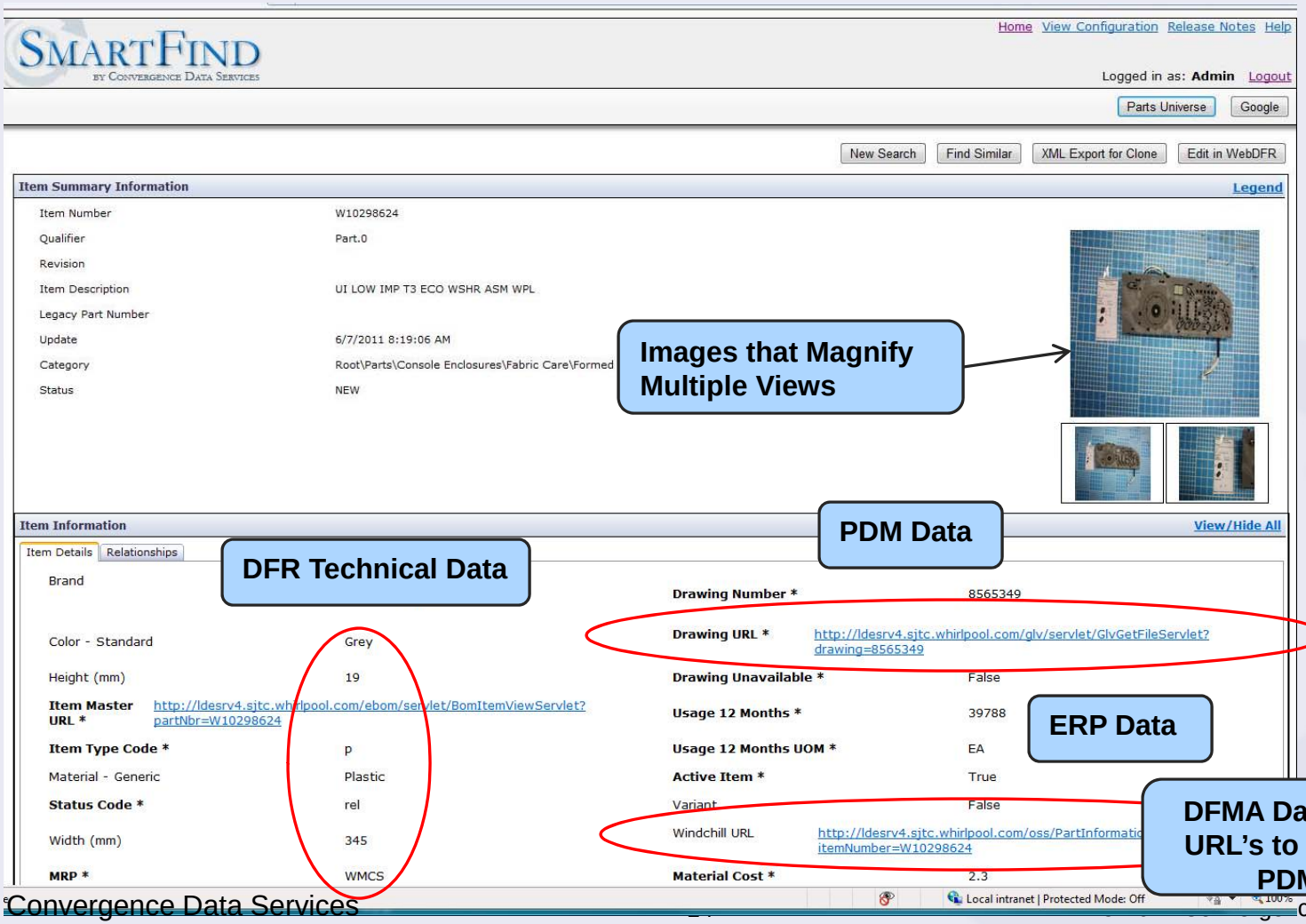
- Search to find product or part cost data
- Use search templates or just add filters manually to search for data



Query/ Report

The DFR/DFMA Integration federates technical, commercial and cost data in one view for better decision making.

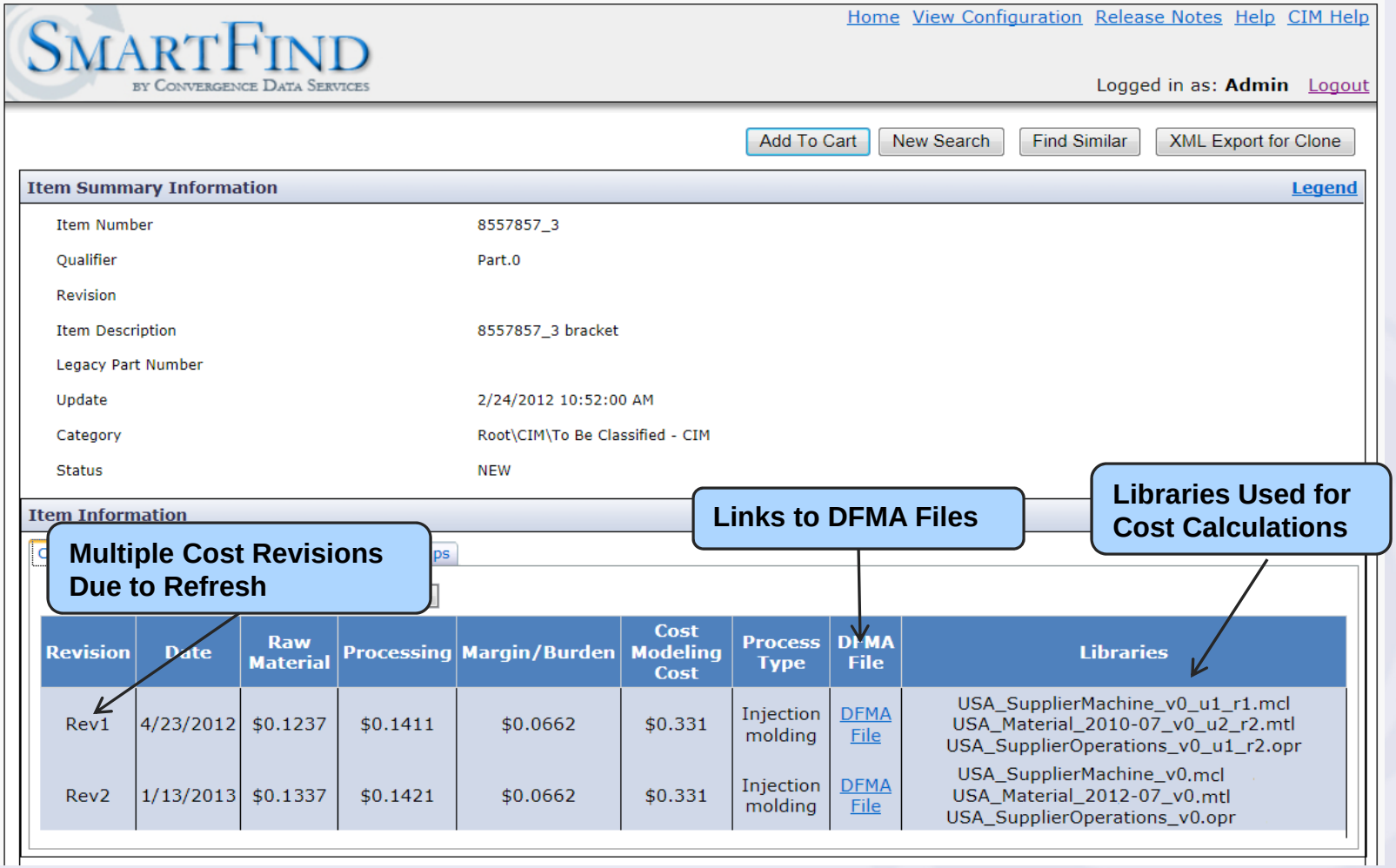
- Displaying data on DFMA ® parts from multiple systems
- Links to drawings, DFMA ® files and images



Query/ Report

Provides full cost history

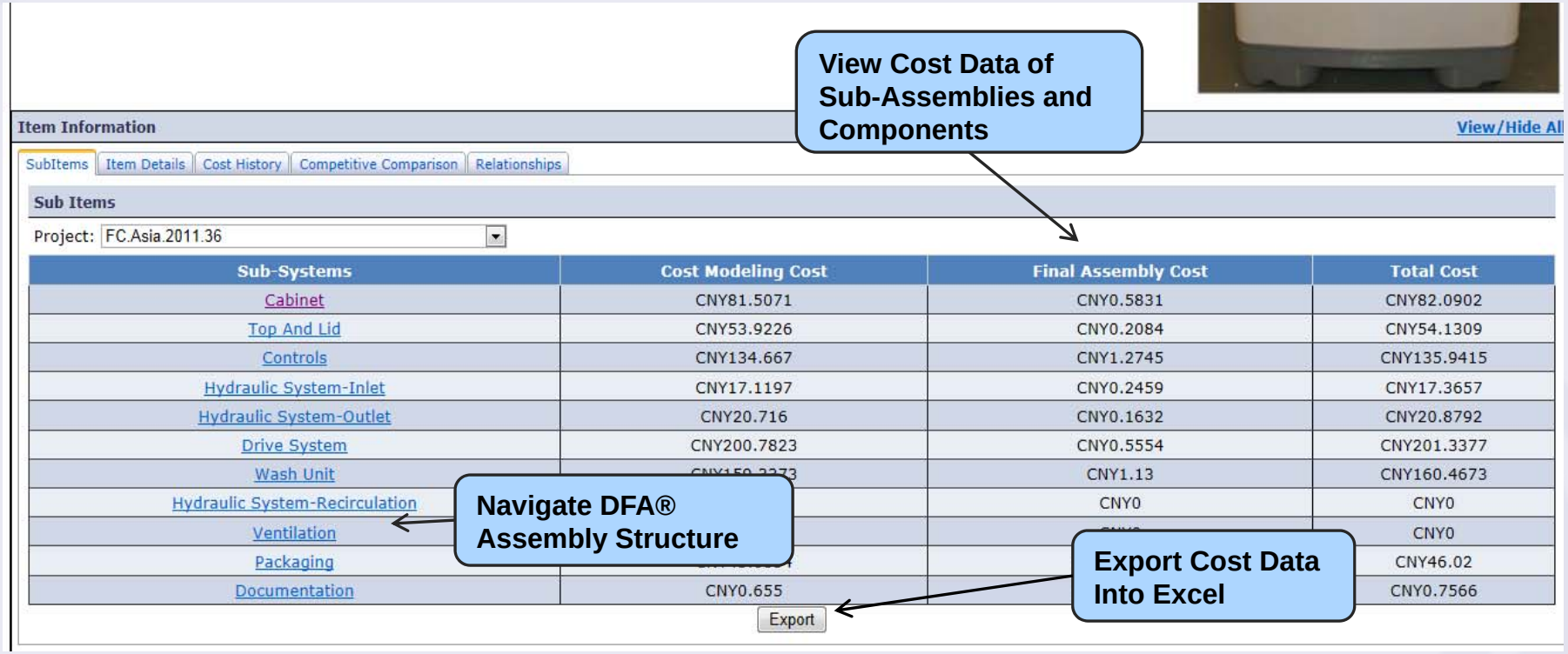
- Provides full history of cost summary data
- Provides access to original DFMA file (DFA/DFM)



Query/ Report

Ability to Navigate the DFMA BOM

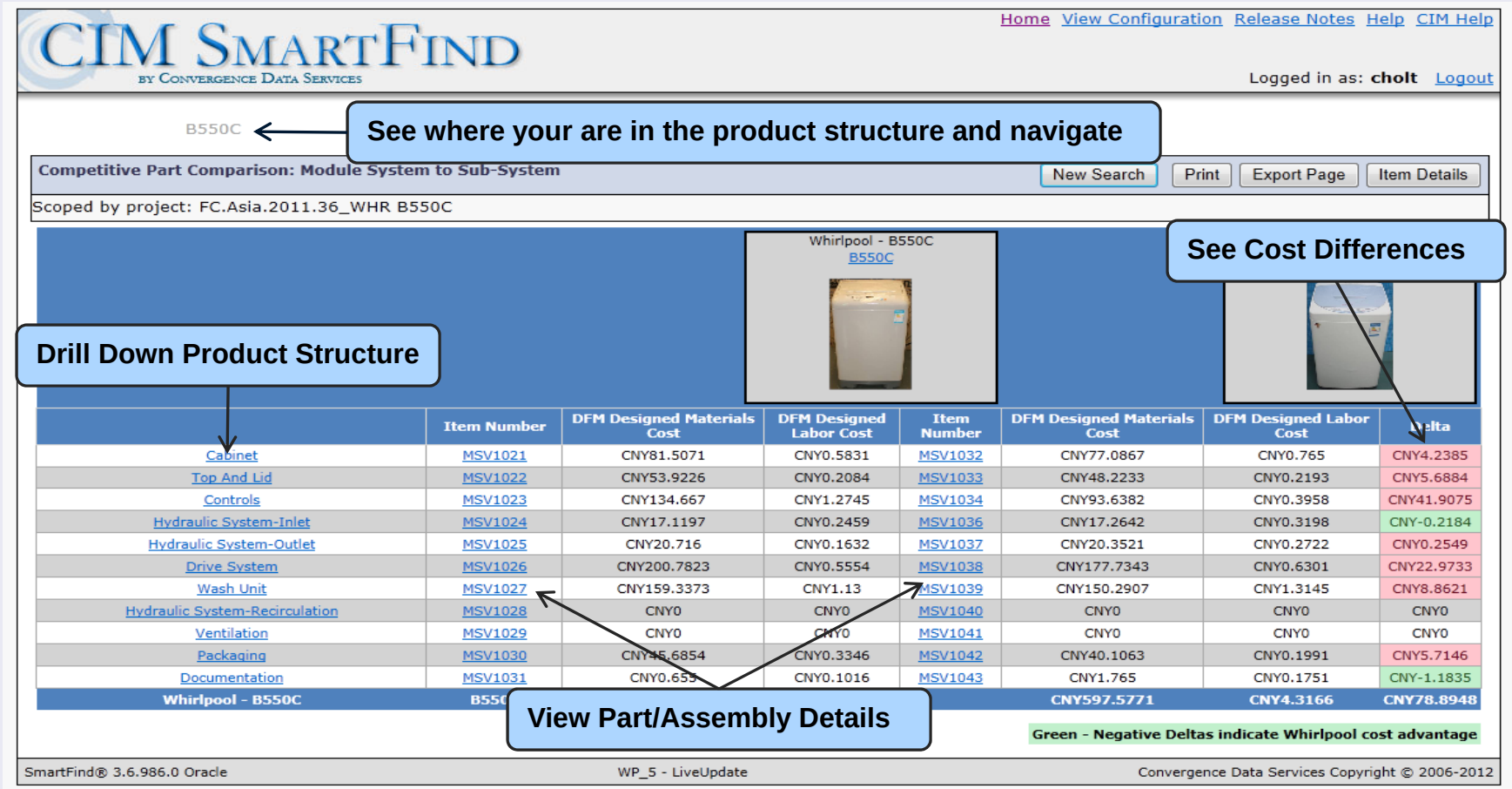
- View Cost Rollups
- Export Cost Data



Query/ Report

Competitive cost reporting with SmartFind Search and Query provides competitive cost "dashboard" capability.

- Compare products by DFMA ® data
- Navigate the product structure as you compare products at different levels



	Item Number	DFM Designed Materials Cost	DFM Designed Labor Cost	Item Number	DFM Designed Materials Cost	DFM Designed Labor Cost	Delta
Cabinet	MSV1021	CNY81.5071	CNY0.5831	MSV1032	CNY77.0867	CNY0.765	CNY4.2385
Top And Lid	MSV1022	CNY53.9226	CNY0.2084	MSV1033	CNY48.2233	CNY0.2193	CNY5.6884
Controls	MSV1023	CNY134.667	CNY1.2745	MSV1034	CNY93.6382	CNY0.3958	CNY41.9075
Hydraulic System-Inlet	MSV1024	CNY17.1197	CNY0.2459	MSV1036	CNY17.2642	CNY0.3198	CNY-0.2184
Hydraulic System-Outlet	MSV1025	CNY20.716	CNY0.1632	MSV1037	CNY20.3521	CNY0.2722	CNY0.2549
Drive System	MSV1026	CNY200.7823	CNY0.5554	MSV1038	CNY177.7343	CNY0.6301	CNY22.9733
Wash Unit	MSV1027	CNY159.3373	CNY1.13	MSV1039	CNY150.2907	CNY1.3145	CNY8.8621
Hydraulic System-Recirculation	MSV1028	CNY0	CNY0	MSV1040	CNY0	CNY0	CNY0
Ventilation	MSV1029	CNY0	CNY0	MSV1041	CNY0	CNY0	CNY0
Packaging	MSV1030	CNY45.6854	CNY0.3346	MSV1042	CNY40.1063	CNY0.1991	CNY5.7146
Documentation	MSV1031	CNY0.655	CNY0.1016	MSV1043	CNY1.765	CNY0.1751	CNY-1.1835
Whirlpool - B550C	**B55**				**CNY597.5771**	**CNY4.3166**	**CNY78.8948**

Lessons Learned and Early Benefits

--Lessons--

- Standardization of processes and inputs can yield significant productivity improvements
- Alignment with “consumers” of cost data is critical to reduce misuse/misunderstanding
- Technology can be used to keep data relevant to current decisions
- Program mapping and reviews are keys to success
- Significant savings from cost modeling is obtainable

Comparing “apples to apples” frees time for value driven decision making

--Early Benefits--

- Productivity gains have reduced future resource costs
- The tool will speed up a process that already saves millions of dollars through procurement analysis
- Millions more have been gained through design changes
- Data linkages to other processes are envisioned
- Users are excited about the increased availability and updating of the data