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ANALYZING CORE COMPETENCE AND CORE PRODUCTS FOR DEVELOPING AGILE AND ADAPTAPTABLE CORPORATION

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Keywords: Core competence, Domain mapping matrix, DMM, Design structure matrix, DSM

1 INTRODUCTION

The core competence concept was introduced by Prahalad and Hamel in 1990, and the concept received much attention particularly in the management field. They were arguing that in short run, a company's competitiveness derives from the price/performance attributes of current products. On the other hand, in the long run the competitiveness derives from an ability to build the core competencies that spawn unanticipated products. The real source of corporate advantage is the abilities to consolidate corporate technologies and products in order to adapt quickly to changing business opportunities (Prahalad & Hamel, 1990).

Core competencies are seen as collective learning in the organization, not individually based learning or skill (Gallon, Stillman & Coates, 1995). Core competence is the way of work is performed, the ability to coordinate diverse production skills, to integrate and harmonize multitude of skills and technologies into products that deliver value to customers. Core competencies are the glue that binds existing business and also the engine for new business development (Prahalad & Hamel, 1990). Core competence is a combination of complementary skills and knowledge bases embedded in a group or team providing a superior product (Coyne, Hall & Clifford, 1997). Core competence has to be linked with end products. In between core competencies and end products we can identify a set of core products that can be used in a number of different combinations and finally different end products. Therefore there are numerous relations between core competencies, core products and end products.

Global competition and the dynamic changes of markets and customers puts pressure on corporations to identify their core competencies in order to develop capabilities to adopt to changing environment and technological development. The crucial issue for management is to perform analysis of what the core competence is in their corporation and how those core competencies can be related to core products and end products. If management does not find those answers they can not put focus in developing long run competencies and technologies that can be combined in a set of core products and strategic end products.

2 RESEARCH APPROACH - MATRIX-BASED APPROACH FOR ANALYZING CORE COMPETENCE

The methodology that is used to handle dependences and relations between items is widely known as the design or the dependency structure matrix (DSM) (Steward, 1981). A DSM is a square matrix representing the elements in a system and their interactions in two alternative ways; clustering of elements in a matrix or partitioning tasks in a matrix (Browning, 2001). DSMs have limited direct utility for inter-domain analyses. Over the years the DSM approach has been extended from the traditional square based matrixes. They have only been applied with this intent with the assumption that two domains did and should contain an equal number of the same elements (e.g., any product component would have a corresponding organizational unit responsible for its development). To move beyond this limitation, a rectangular matrix, mapping from one domain to another, is required. Only with such a rectangular matrix can the dynamics between different domains can be captured, relations and dependencies identified, and information that needs to be exchanged pointed out.

Danilovic presented studies of dependencies between domains, product architecture versus organization structure and task structure versus organization structure. Danilovic and Sigemyr presented dual-domain analyses of product requirements, product specifications, functional requirements, and product components. In addition, Maurer et al. showed a rectangular matrix relating product architecture and customer requirements. To make a clear distinction between the square matrices that provide a self-mapping of the relationships among the elements of a system in a single domain and the rectangular matrices that map the elements of one domain to another, we developed the term domain mapping matrix (DMM) for the latter set to provide contrast with the term DSM, which has traditionally applied to the former set. Thus, while a DSM is always a square matrix, a DMM will usually be rectangular, although it can be square in cases where two domains contain an equal number of elements in their respective systems (Danilovic and Browning, 2006).

3 APPLICATION OF DOMAIN MAPPING MATRIX

In this research we worked intensively with a small and high-technology based Swedish corporation. This corporation has been very successful in developing new technological solutions and incorporating them into new products on the international markets. The major issue was how to understand what was the core competence of this corporation on order to achieve focus in the development of core products and how to identify competence areas that needed to be developed in order to support future core and end products. This core competence, core products and end products analysis is seen as a strategic issue.

Initially, all relevant competence areas for all departments were listed by main areas, which in order to be more specific was sub-divided on up to three levels. Likewise, a list of prioritized products was formulated by listing main product areas with one level of sub-division. The term "product" covers any delivery from the department no matter whether it is hardware, software, IP or a service. The two analyses of relevant competence and prioritized core products, respectively, are used as the input for the DMM with relevant competence in the vertical axis and prioritized products in the horizontal axis. Since the DMM method is used as a tool for analyzing strategic resource needs a new step is added to the procedure. Each relevant competence in the vertical axis the matrix is given a value from 0 to 3 according to a self-evaluation of the skills in the department within the given competence areas. The meaning of the scale is as follows:

0	No skills
1	Low skills
2	Medium skulls
3	High skills

The input to the DMM is finalized by indicating the importance of each competence in the vertical axis for each product in the horizontal axis in the following way:

0	No importance (white)
1	Low importance (yellow)
2	Medium importance (violet)
3	High importance (red)

Based on that analysis a comprehensive DMM is designed and the matrix was clustered.

4 RESULTS

When DMM matrix was clustered a number of patterns were exposed. In the first place we could expose the patterns of different areas of competencies, with a number of competence sub-levels, and products. Finally the patterns of competencies and products could be related to each other and clustered into a few areas of well identified core competencies and core products. Besides those major patterns a number of other patterns were identified that showed possible direction for competence and product diversification.

In addition, the DMM analysis identified areas of knowledge that were strategically important and could be deployed further and showed areas for the development of new core products. When those core competence and core product areas were exposed resource allocation could be made in order to develop existing and new core competencies.

Small corporations in particular are depending on collaboration with other companies in different organizational settings. The DMM analysis identified areas where alliances could be developed in order to strengthen identified core competencies and exploit core products and outsourcing of non-core competence areas. For strategic and long run business development the DMM analysis exposed the areas for acquisition of new competencies and technologies for future core products and end products.

REFERENCES

Gallon, M., Stillman, H. M., and Coates, D., Putting Core Competency Thinking Into Practice, Research Technology Management 38, no. 3 (May/June 1995): 20-29.

Prahalad, C. K., and Hamel, G., 1990, The Core Competence of the Corporation, Harvard Business Review, May-June, pp. 2-15.

Coyne, K. P., Hall, J, D., and Clifford, P, G., 1997, Is Your Core Competence a Mirage?, McKinsey Quarterly, Mar. 1: 40-55.

Browning T. R., 2001, Applying the Design Structure Matrix to System Decomposition and Integration Problems: A Review and New Directions. IEEE Transactions on Engineering Management, 48(3): 292-306

Danilovic, M., Börjesson, H., 2001, Managing the Multi-Project Environment. In: Proceedings of the 3rd International Design Structure Matrix Workshop, Oct. 29-30, Cambridge, MA.

Danilovic, M., Börjesson, H., 2001, Participatory Dependence Structure Matrix Approach. In: Proceedings of the 3rd International Design Structure Matrix Workshop, Oct. 29-30, Cambridge, MA.

Danilovic, M., Sigemyr, T., 2003, DSM Approach in Early Product Development Phases. In: Proceedings of the 5th International Design Structure Matrix (DSM) Workshop, Oct. 22-23, Cambridge, UK.

Danilovic, M., Browning, T., 2007, Managing Complex Product Development Projects with Design Structure Matrices and Domain Mapping Matrices. International Journal of Project Management, Vol 25, No 3, pp. 300-314.

Maurer, M., Pulm, U., Lindeman, U., 2003, Tendencies Towards More and More Flexibility. In: Proceedings of the 5th International Design Structure Matrix (DSM) Workshop, Oct. 22-23, Cambridge, UK.

Steward, D. V., 1981, The Design Structure System: A Method for Managing the Design of Complex Systems. IEEE Transactions on Engineering Management, 28(3):71-74

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IN COOPERATION WITH BMW GROUP
CAPITALIZE ON COMPLEXITY

The importance of core competence

- The core competence concept was introduced by Prahalad & Hamel in 1990.
- In the short run a company's competitiveness derives from the price/performance attributes of current products.
- In the long run the competitiveness derives from an ability to build the core competencies that spawn unanticipated products.
- The real source of corporate advantage is the abilities to consolidate corporate technologies and products in order to adapt quickly to changing business opportunities.
- Core competence is the way work is performed, the ability to coordinate diverse production skills, to integrate and harmonize multitude of skills and technologies into products that deliver value to customers.
- Core competence is the glue that binds existing business.
- Core competence is the engine for new business development (Prahalad & Hamel, 1990).
- Core competence is a combination of complementary skills and knowledge bases embedded in a group or team providing a superior product (Coyne, Hall & Clifford, 1997).
- Core competence has to be linked with end products.
- In between core competencies and end products we can identify a set of core products that can be used in a number of different combinations and finally different end products.
- There are numerous relations between core competencies, core products and end products.

Product Development
Technische Universität München

Times are changing and adaptation to changes is a challenge

- Global competition and the changes of markets, customers, and technology, puts pressure on corporations to adapt to change

- To adapt to new challenges corporations must reflect on their core competencies and develop capabilities to adapt to changes in order to be healthy
  - Identify their present core competencies
  - Identify present core and end products
  - Develop new end products and combinations of old and new core products
  - Develop new core competencies that matches new core and new end products

Research issues

- The crucial issue for management is to understand and identify the core competences, and
- how those core competencies can be related to core products and end products
- How can we identify core products among deliverables and end products?
- How can we identify knowledge areas and skills that are core competences from a corporate perspective?
- If management does not find those answers they can not put focus in developing competencies and technologies in the future that can be combined in a set of new core products and new end products

Research approach – Information driven management approach

- We explore the structure of the problem to make assumptions explicit, rather than implicit
- The structure of the problem is seen as a spreadsheet showing for each item the information needed to solve the problem and what other items it directly depends on
- Matrices are used to map a set of items toward itself (NxN) or to map a set of items toward another set of items (NxP)
  - NxN approach is named Design (or Dependence) Structure Matrix (DSM) (Steward 1967, 1981, Eppinger et. al.)
  - NxP approach is named Domain Mapping Matrix (DMM) (Danilovic, 2001, 2005, Maurer 2005, Danilovic & Browning, 2007)

Participative research approach

- Research method
  - Interviews with people in one small company
  - Direct observation of their daily work in product development
  - Workshops using dialogue in identifying relations between competences and products
- Feedback of data and the analysis to respondents in order to check that chosen approach is reasonable well reflecting their working experiences
- Feedback to management in order to support their strategically analysis of data in order to define strategic actions to achieve core competence development in the company

Step 1 – Identification of competencies

IDENTIFIED COMPETENCES			
LEVEL 1 Competence 7 Areas	LEVEL 2 Competence 37 Areas	LEVEL 3 Competence 16 Areas	LEVEL 4 Competence 4 Areas
High frequency (GHz) Design			
	Circuit Design		
	Integrated Components		
		Substrate	
			Lumped
			Distributed
		Chip	
			CMOS
			SiGe
		Antenna	
	Interconnect		
Electronic System Design			
	Circuit Design		
	Radar System		
	Radio Transceiver		
	Embedded Electronic		
		FPGA Programming	
		Analog	
		Digital	
	Thermal Management		
	Software		
		C++	
		Labview	
Internal Substrate Processing			
	Mask production		
	MCM-D (BCB,Cu/Ti/Al)		
	MCM-D embedded passives		
		MIM	
		Resistor (SiCr,NiCr)	
	Flex		
	Wafer back-etching		
External Substrate Processing			
	MCM-C		
	PCB		
	Flex		
Substrate Design			
	PCB/MCM-L		
	MCM-D		
	LTCC/HTCC		
Internal Prototype Electronics Assembly			
	Flip Chip Mounting		
	Bumping		
		Stud bumping	
		Electroplated	
	Wire ball bond Au		
	Wedge/Ribbon bond Au/Cu/Al		
	SMT		
	Encapsulation		
	Electroplating		
	Electroforming		
Characterization			
	High Frequency Measurement Techniques		
		On-chip	
		On-substrate (SMA)	
	Radar System		
	Radio Transceiver		
	Antenna		
		2-26GHz	
		26-80GHz	
	Thermal		

- Seven major competence areas were identified
- For each of the major seven competence areas sub-competence areas were identified
- A competence hierarchy was outlined

Step 2 – Identification of products and subsystems

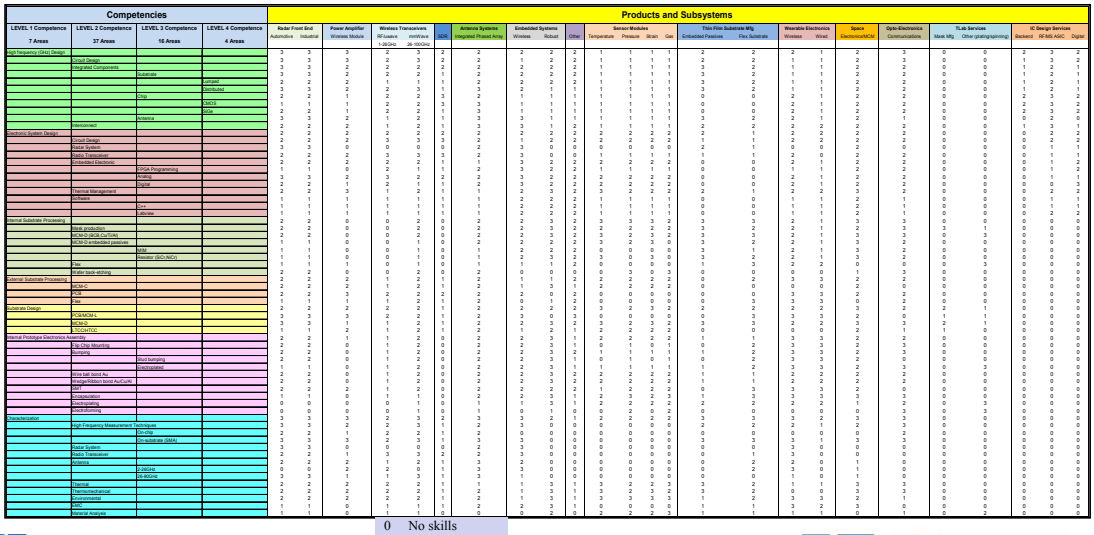
PRODUCT STRUCTURE - MAJOR PRODUCTS AND SUBSYSTEMS

Radar Front End			
Automotive	Industrial		
Power Amplifier			
Wireless Module			
Wireless Transceivers			
RF/uwave	mmWave		
1-26GHz	26-100GHz		
SDR			
Antenna Systems			
Integrated Phased Array			
Embedded Systems			
Wireless	Robust		
Other			
Sensor Modules			
Temperature	Pressure	Strain	Gas
Thin Film Substrate Mfg			
Embedded Passives	Flex Substrate		
Wearable Electronics			
Wireless	Wired		
Space			
Electronics/MCM			
Opto-Electronics			
Communications			
TLab Services			
Mask Mfg	Other (plating/spinning)		
IC Design Services			
Backend	RF/MS ASIC	Digital	

- 14 major and strategically important products / subsystem areas were identified
- Within 8 major product areas sub-products were identified

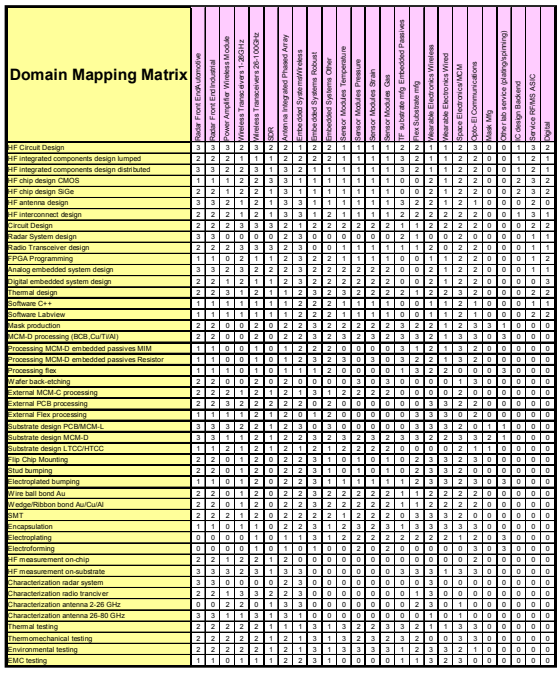
Step 3 – Mapping competences across products

- Mapping of identified competence areas across products and subsystems
- Each *relevant competence area* in the table is given a value from 0 to 3 according to a self-evaluation of present/available skills within identified competence areas related to major products



0	No skills
1	Low skills
2	Medium skulls
3	High skills

Step 4 – Domain Mapping Matrix (DMM) were designed

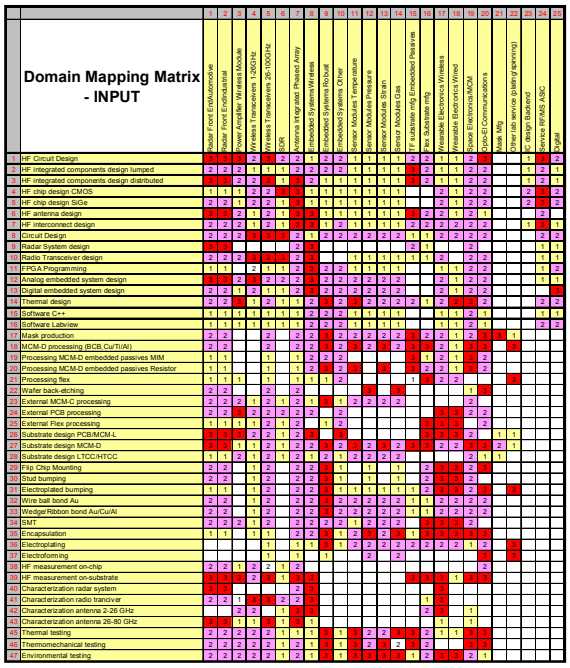


Domain Mapping Matrix

	Radar Front End/Automotive	Radar Front End/Industrial	Power Amplifier Wireless Module	Wireless Transc.evers 1..2GHz	Wireless Transceivers 26.1GGHz	SDR	Antenna Integrated Phased Array	Embedded Systems/Wireless	Embedded Systems Robust	Embedded Systems Other	Sensor Modules Temperature	Sensor Modules Pressure	Sensor Modules Strain	Sensor Modules Gas	Sensor Modules mfg. Embedded Passives	Flex Substrate mfg.	Wearable Electronics Wireless	Wearable Electronics Wired	Space Electronics/MCM	Opto-IC Communications	Mask Mfg.	Other lab service (plating/sputtering)	IC Design Backend	Service RF/MS ASIC	Digital
HF Circuit Design	3	3	3	2	3	2	2	1	2	2	1	1	1	1	2	2	1	1	2	3	0	0	1	3	2
HF integrated components design lumped	3	3	2	2	1	1	3	2	2	2	1	1	1	1	3	2	1	1	2	2	0	0	1	2	1
HF integrated components design distributed	3	3	2	2	3	1	3	2	1	1	1	1	1	1	3	2	1	1	2	2	0	0	1	2	1
HF chip design CMOS	1	1	1	2	2	3	3	1	1	1	1	1	1	1	0	0	2	1	2	2	0	0	2	3	2
HF chip design SiGe	2	2	1	2	2	1	3	1	1	1	1	1	1	1	0	0	2	1	2	2	0	0	2	3	2
HF antenna design	3	3	2	1	2	1	3	3	1	1	1	1	1	1	3	2	2	1	2	1	0	0	0	2	0
HF interconnect design	2	2	2	1	2	2	1	3	2	1	1	1	1	1	2	2	2	2	2	2	0	0	1	2	1
Circuit Design	2	2	2	3	3	3	2	1	2	2	2	2	2	2	1	1	2	2	2	2	0	0	2	2	2
Radar System design	3	3	0	0	0	0	2	3	0	0	0	0	0	2	1	0	0	2	0	0	0	0	1	1	
Radio Transceiver design	2	2	2	3	3	3	2	3	0	0	1	1	1	1	1	1	2	0	2	2	0	0	0	1	1
FPGA Programming	1	1	0	2	1	1	2	3	2	2	1	1	1	1	0	0	1	1	2	2	0	0	0	1	2
Analog embedded system design	3	3	2	2	2	2	2	3	2	2	2	2	2	2	2	0	0	2	1	2	2	0	0	1	1
Digital embedded system design	2	2	1	2	1	1	2	3	2	2	2	2	2	2	0	0	2	1	2	2	0	0	0	0	3
Thermal design	2	2	3	1	2	1	1	2	3	2	2	2	2	1	2	2	3	2	2	0	0	0	2	2	
Software C++	1	1	1	1	1	1	1	2	2	2	1	1	1	1	0	0	1	1	2	1	0	0	0	1	1
Software Labview	1	1	1	1	1	1	1	2	2	2	1	1	1	1	0	0	1	1	2	1	0	0	0	2	2
Mask production	2	2	1	0	2	0	2	2	3	2	2	2	2	2	3	3	2	2	3	3	0	0	0	0	0
MCM-D processing (BCB,CuTiW)	2	2	2	0	0	2	0	2	2	3	2	3	2	3	2	3	3	2	1	3	3	0	3	0	0
Processing MCM-D embedded passives MIM	1	1	1	0	0	1	0	1	2	2	2	0	0	0	0	3	1	2	1	3	2	0	0	0	0
Processing MCM-D embedded passives Resistor	1	1	1	0	0	1	0	1	2	3	2	3	0	3	0	3	2	2	1	3	2	0	0	0	0
Processing flex	1	1	1	1	0	1	0	1	1	1	2	0	0	0	0	1	3	2	2	0	0	0	0	0	0
Wafer back-etching	2	2	2	0	0	2	0	2	2	0	0	0	0	3	0	3	0	0	0	2	0	0	0	0	0
External MCM-C processing	2	2	2	1	2	1	2	1	3	1	2	2	2	2	0	0	0	0	2	0	0	0	0	0	0
External PCB processing	2	2	3	2	2	2	2	2	2	0	2	0	0	0	0	0	3	3	2	2	0	0	0	0	0
External Flex processing	1	1	1	1	2	1	2	0	1	2	0	0	0	0	0	0	3	3	3	0	2	0	0	0	0
Substrate design PCB/MCM-L	3	3	3	3	2	2	1	2	3	0	3	0	0	0	0	0	3	3	2	2	1	0	0	0	0
Substrate design MCM-D	3	3	1	1	2	1	2	2	3	2	2	3	2	3	2	3	2	2	2	3	2	1	0	0	0
Substrate design LTCC/HTCC	1	1	2	1	2	1	2	1	2	1	2	2	2	2	0	0	0	0	2	1	1	0	0	0	0
Flip Chip Mounting	2	2	2	0	1	2	0	2	2	3	1	0	1	0	2	3	3	2	3	0	0	0	0	0	0
Stud bumping	2	2	2	0	1	2	0	2	2	3	1	0	1	0	1	0	2	3	3	2	0	0	0	0	0
Electroplated bumping	1	1	1	0	0	1	0	1	1	1	1	0	1	0	1	0	2	3	3	2	3	0	0	0	0
Wire ball bond Au	2	2	2	0	1	2	0	2	2	3	2	2	2	2	2	1	1	2	2	2	2	0	0	0	0
Wedge/Ribbon bond Au/Cu/Al	2	2	2	0	1	2	0	2	2	3	2	2	2	2	2	1	1	2	2	2	2	0	0	0	0
SMT	2	2	2	2	1	2	0	2	2	2	2	1	2	2	2	0	3	3	3	2	0	0	0	0	0
Encapsulation	1	1	1	0	1	1	0	2	2	3	1	2	3	2	3	1	3	3	3	3	3	0	0	0	0
Electroplating	0	0	0	0	0	1	0	1	1	1	2	2	2	2	2	2	2	2	1	2	2	0	0	0	0
Electroforming	0	0	0	0	0	1	0	1	0	1	0	0	2	0	2	0	0	0	0	0	3	0	0	0	0
HF measurement on-chip	2	2	1	2	2	1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
HF measurement on-substrate	3	3	3	2	3	1	3	3	0	0	0	0	0	3	3	3	1	3	3	0	0	0	0	0	0
Characterization radar system	3	3	0	0	0	0	2	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Characterization radio trancsiver	2	2	1	3	3	2	2	3	0	0	0	0	0	0	1	1	3	0	0	0	0	0	0	0	0
Characterization antenna 2-26 GHz	0	0	2	2	0	1	3	3	0	0	0	0	0	0	0	2	3	0	1	0	0	0	0	0	0
Characterization antenna 26-80 GHz	3	3	1	1	3	1	3	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Thermal testing	2	2	2	2	2	2	1	1	1	3	1	3	2	2	3	3	2	1	1	3	3	0	0	0	0
Thermomechanical testing	2	2	2	2	2	2	1	2	1	3	1	3	2	3	2	3	2	0	0	3	3	0	0	0	0
Environmental testing	2	2	2	2	2	2	1	2	1	3	1	1	3	3	3	3	1	1	3	2	1	0	0	0	0
EMC testing	1	1	0	1	1	1	2	2	3	1	0	0	0	0	1	1	3	2	3	0	0	0	0	0	0

- Rows reflects identified competence areas
- Columns reflects identified major products/subsystems
- Points of interaction contains information on how each competence is related to each product

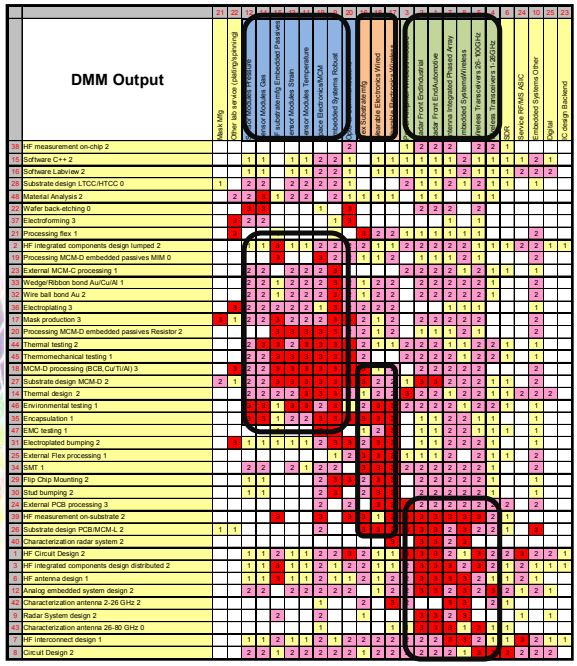
Step 5 – DMM analysis in Complex Problem Solver



- Visualization of interdependencies by colors
- The input to the DMM is indicating the importance of each competence in the vertical axis (rows) for each product in the horizontal axis (columns) in the following way:

0	No importance (white)
1	Low importance (yellow)
2	Medium importance (violet)
3	High importance (red)

Step 6 – DMM Output – Identification of core products

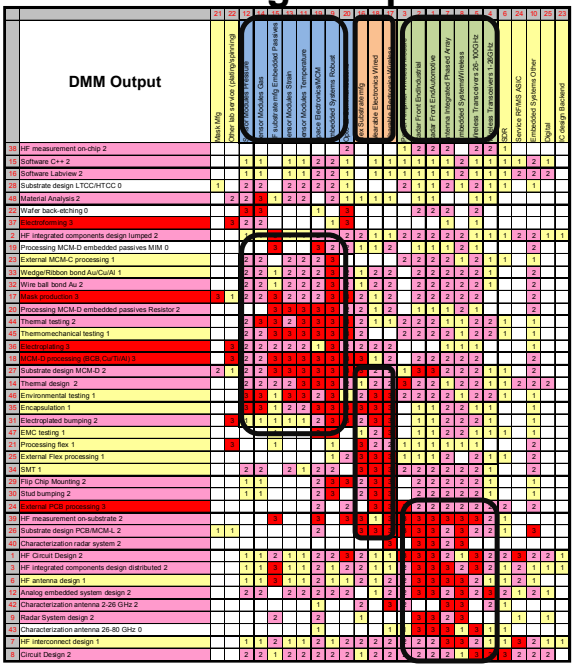


- DMM analysis identifies three **CORE PRODUCT** areas
- Identification of three major product areas i.e. **CORE PRODUCTS:**
  - Embedded modules
  - Flexible electronics (including wearable computers)
  - Wireless high frequency systems
- Those **CORE PRODUCTS** are strategically important to focus on from corporate perspective

Step 7 – Detailed description of CORE PRODUCTS and its major competence areas

Detailed description of identified clusters			
Cluster	1. Upper left	2. Center	3. Lower right
Characteristics	Embedded modules	Flexible electronics	Wireless HF
Products	- Sensor Modules Pressure.	- Flex Substrate mfg.	- Power Amplifier Wireless Module.
	- Sensor Modules Gas.	- Wearable Electronics Wired.	- Radar Front EndIndustrial.
	- Thin film substrate mfg Embedded Passives.	- Wearable Electronics Wireless.	- Radar Front EndAutomotive.
	- Sensor Modules Strain.		- Antenna Integrated Phased Array.
	- Sensor Modules Temperature.		- Embedded Systems Wireless.
	- Space Electronics/MCM.		- Wireless Transceivers 26-100GHz
	- Embedded Systems Robust.		- Wireless Transceivers 1-26GHz.
	- Opto-El Communications.		
Mostly needed competence	- External MCM-C processing.	- Electroplating	- SMT
	- Wedge/Ribbon bond Au/Cu/Al	- MCM-D processing (BCB,Cu/Ti/Al)	- Flip Chip Mounting
	- Wire ball bond Au	- Substrate design MCM-D	- Stud bumping
	- Mask production	- Thermal design	- External PCB processing
	- Processing MCM-D embedded passives Resistor	- Environmental testing	- HF measurement on-substrate
	- Thermal testing	- Encapsulation	- Substrate design PCB/MCM-L
	- Thermomechanical testing	- Electroplated bumping	- Characterization radar system
	- Electroplating	- EMC testing	- HF Circuit Design
	- MCM-D processing (BCB,Cu/Ti/Al)	- Processing flex	- HF integrated components design distributed
	- Substrate design MCM-D	- External Flex processing	- HF antenna design
	- Thermal design	- SMT	- Analog embedded system design
	- Environmental testing	- Flip Chip Mounting	- Characterization antenna 2-26 GHz
	- Encapsulation	- Stud bumping	- Radar System design
	- Electroplated bumping	- External PCB processing	- Characterization antenna 26-80 GHz
		- HF measurement on-substrate	- HF interconnect design
		- Substrate design PCB/MCM-L	- Circuit Design
			- Radio Transceiver design
			- Characterization radio tranciver
			- HF chip design SiGe

Step 8 – Identification of CORE COMPETENCES – matching competencies and core products



- Identification of **CORE COMPETENCIES** were based on identified **CORE PRODUCTS**
- By comparing the actual skills of the mostly needed competence areas with the needed skills (discrepancy) indicated in respective clusters, competence areas
  - with critically low skills can be identified. and
  - strategically important competence areas can be identified
- In the DMM analysis a color code has been used to highlight the actual skill in each competence area according to the following scale:
  - 0-No skills, white colour,
    - 4 competence areas were identified
  - 1-Low skills, yellow colour,
    - 11 competence areas were identified
  - 2-Medium skills, violet colour,
    - 22 competence areas were identified
  - 3-High skills areas, red colour,
    - 5 competence areas were identified

Step 9 - Identified discrepancy in competence areas – present competence level and strategically needed competence

Skill	Present level	Needed level	Conclusion	Possible solution on competence problem
Wedge/Ribbon bond Au/Cu/Al	Low	Medium	Potential lack of competence	Realise budgeted investment in new bond head and practice with it.
Thermal testing	Medium	High	Potential lack of competence	Increase access to competence through cooperation with YY and eventually XX
Thermomechanical testing	Low	High	Serious lack of competence	Increase access to competence through cooperation with YY but even YY is not on a high level. Competence increasing projects are needed.
Substrate design MCM-D	Medium	High	Potential lack of competence	General PCB/MCM design competence has typically been achieved by consultants or ex-jobb.
Environmental testing	Low	high	Serious lack of competence	Increase access to competence through cooperation with XX
Encapsulation	Low	high	Serious lack of competence	Require competence in encapsulation by future recruitment in Jönköping.
External Flex processing	Low	High	Serious lack of competence	Flex circuit design and processing has not been needed yet.
SMT	Low	High	Serious lack of competence	Traditional packaging/assembly competence is lacking.
HF measurement on-substrate	Medium	High	Potential lack of competence	Current projects must be verified at 80GHz- upgrade lab or find partner.
Substrate design PCB/MCM-L	Medium	High	Potential lack of competence	Maybe by influencing future recruitment in electronic design at YY and establishing cooperation.
HF antenna design	Low	High	Serious lack of competence	Should be solved by recruitment 2006
Characterization antenna 26-80 GHz	Non	Medium	Serious lack of competence	Make agreement with XX, who already has invested in equipment and skilled personal
Radio Transceiver design	Low	High	Serious lack of competence	Training and recruitment.

Conclusions

- DMM analysis enabled to expose different areas of competencies, with a number of competence sub-levels
- DMM analysis enabled to expose different areas of end products and identify core products
- DMM analysis identified patterns across competencies and products
  - Those patterns could be related to each other and clustered into few areas of well identified core competencies and core products
  - A number of other patterns were identified that showed possible direction for competence development, and product diversification
- In addition, the DMM analysis identified competence areas
  - that were strategically important and
  - could be deployed further and
  - identified areas for the development of new core products
- When those core competence and core product areas were identified resources could be re-allocated in order to exploit existing and develop new core competencies
- In particular small corporations are depending on collaboration with other companies in different organizational settings.
  - The DMM analysis can be used to identify areas where strategic alliances could be developed in order to exploit identified core competencies and core products and outsource non-core competences
- For strategic and long run business development the DMM analysis exposed the areas for acquisition of new competencies and technologies for future core products and end products