

Cost Benefits of the Platform Principles for Tractors and Other Agricultural Machinery.

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1 Introduction

In recent decades an agricultural equipment global manufacturer, such as CNH, has seen the following market trends and drivers:

- 1) Steady or decreasing volumes, driven by
 - a) saturation of North American and European markets
 - b) slow development of emerging markets
- 2) Increasing number of models and product configuration variants
 - a) evolution of cultivation practices and techniques
 - b) increasing variety of implements
 - c) expansion of transport and material handling activities
 - d) desire/need to meet more customer requirements
- 3) Increasing power/capacity
 - a) productivity increase demand
 - b) farm size increase (due to farm concentration)
 - c) implements evolution
- 4) Increasing automation
 - a) productivity increase demand
 - b) demand for comfort improvement
 - c) demand for more safety
- 5) Strong demand for less pollution (emissions, noise) and more safety
 - a) legislation evolution
 - b) increasing user sensitivity
- 6) Increasing demand for services (support and information)
 - evolution of farm organization.

This has impacted on every manufacturer, causing in general:

- high competitive pressure
- increasing product complexity
- higher speed for product development
- more external constraints (legislation)
- need for market and customer base expansion.

The manufacturer's typical response has been:

- product offering expansion
- search for new markets and customers
- globalization
- product development practices evolution.

The manufacturer's reaction has been particularly focused on the new product development, taking actions like:

- balance higher product offering complexity with higher component/sub-system standardization
- develop/expand product families
- develop global products (common design base, with multiple configuration variants to meet different user requirements)
- globalize supplier base
- carefully plan product developments, to optimize investments.

2 Product families / Platforms

It is interesting to observe that actual product development in different companies has apparently followed the base law defined by Prof. K.T. Renius: “keep the relation between the number of living parts and the number of produced models as low as possible” (K.T. Renius, Lectures on tractor engineering, RWTH Aachen, 1976).

If we apply this law to the evolving environment just described, we understand the need for agricultural equipment manufacturers to put an extraordinary effort in the component standardization.

In effect, they have developed families of products, also called “product platforms”, with various models sharing an increasing number of common components.

The characteristics of these families are clearly described in another work of prof. K.T. Renius, Global tractor development: product families and technology levels (30th Opatija Symposium, 2002 (see Fig.1 and 2).

Fig. 1 – Tractor families: simplified cost structure

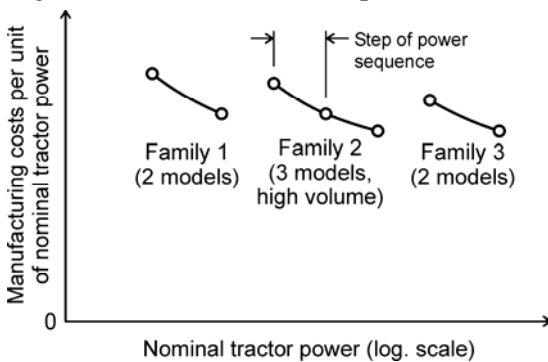


Fig. 2 – Tractor family specifications

Tractor family	1	2	3	4
Rated engine kW	30 – 55	60 – 90	90 – 125	135 – 210
Market trend (units)	↘	↔	↗	↗
Number of functions	moderate	high	very high	high
Diesel engine	3 cylinder, ~ 3 l	4 cylinder, ~ 4 l	6 cylinder, ~ 6 l	6 cylinder, > 7 l
Gear box	Synchro-mesh with reverser. Hi-Lo or L-M-H power shift opt. CVT studies	Synchronized ranges, 3 or 4 speeds and reverser power shifted		Full power shift including reverse
		Full power shift opt.		
	Continuously variable transmissions (CVT) upcoming Automatic shift functions upcoming for all transmissions			
	Top speeds: EU 40 km/h, Germany optional 50 km/h (Fendt 1993)			
Axle concepts (FWD dominant)	Total axle speed reduction: 30–40 (rear axle), 15–25 (front axle). Planetary final drives, wet disc brakes. Automatic shift and hydropn. suspensions upcoming			

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2.1 The manufacturer's perspective

All manufacturers have applied the product family concept quite extensively. CNH, for example, has followed a similar path, with some peculiar characteristics.

The concept of product families (product platforms) was known and applied by the root companies since before the merger between New Holland and Case. With the creation of CNH this has been enhanced even more, for the following reasons:

- opportunities to serve more customers world-wide
- opportunities for synergy and product offering rationalization
- opportunities for the standardization of components across products and product lines
- new technologies and solutions adopted for multiple products
- platform organization dedicated to manage product development
- implementation of a reinforced Global Product Development Process
- development of families of components
- globalization of the supplier base.

In few years from the creation of CNH most of the products have been renewed, all with the concept of common platform. Existing New Holland and Case IH products have been initially “merged” into new product families, communizing the best technologies and components. Then they have been heavily differentiated by brand, developing brand-specific features and characteristics. The product families have been kept as wide as possible, using the maximum flexibility of key component families as engines, transmissions, front axles, cabs, hydraulic systems, electronic systems, etc. The standardization process has also involved technical solutions, embedded in different products, sometimes even using some different components, but within the same design framework and validation process.

From the organization point of view, a multifunctional team has been created for each main product range, called “Platform team” that owns and coordinates the product development process. The Platform team is led by a project manager and is composed by representatives of all the functions that participate in the product development process (engineering, manufacturing, commercial, purchasing, finance, etc.). So the products are developed in families, with a continuous and joint effort by all the involved company functions. All Platform teams use a common process frame (GPD) and common methodologies and tools. Engineering “Competence Centers” that work across all platforms and product lines guarantee the maximum standardization of components and technologies.

Each product is developed with a unique effort from a global perspective, considering all together the needs of all possible customer world-wide, so to plan for the best “base” product family and the many required configuration options. And this has led to a significant optimization of the product cost for a given value for the customer. Also the manufacturability has been improved, keeping under control the complexity seen by the plants. Components sourced from global suppliers have allowed for minimal cost and best integration of the value chain with CNH manufacturing plants. Common systems to support product development are also helping the global effort to maximize synergies and maintain the focus on product platforms

So, in short, a typical agricultural equipment manufacturer tends to put the product platform concept at work in multiple ways:

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- developing families of “global” products, with as many models as possible in each family (to limit development investments and product cost)
- standardizing components (another cost reduction driver)
- applying modular sub-systems to a common base (again cost optimization)
- adapting and improving product development methodologies and organizations (to improve effectiveness and efficiency)
- investing on variety of configurations on a given base more than on separate different models (optimize and focus the effort).

A big effort was required in CNH to accomplish all that.

First of all creating a common culture in all the product development centers, to understand and support the “platforming” concept as an opportunity for the company and a real value for our customers. This required to adapt the organization and to deploy an extensive training program.

Then resolving all the technical issues related to the component standardization and the cost optimization of the family lower-end models.

The key to success has been for CNH the clear strategy and the strong and total commitment, led by top management but actually pervaded through the entire organization.

2.2 The customer’s view

The variety of customers and customer needs have significantly evolved and differentiated in the last decades, due to:

- the evolution of cultivation techniques
- the availability of new and improved crops
- the economic and agricultural growth of many countries
- the evolution of the social life.

Most of the agricultural machinery manufacturers have responded to these facts with a huge increase of their product offering variety and complexity (in the ’60s each of the major tractor manufacturers offered less than 10 tractor models in total; today no one has less than 100 models, plus an infinite series of options...). And this has been done mainly developing product families, with an increasing number of models and versions within each single family.

For customers this has represented an increased possibility to find the right machine for their needs and more alternatives of different brands for similar products.

The product platform concept has also benefited customers, because:

- reduced manufacturing cost in a competitive market environment helps containing retail prices
- standardization of components and technical solutions reduces spare parts and simplifies repairs
- variety of product configurations well serves customer-specific requirements
- basic configurations of newly developed products can be offered to developing countries, instead of old models originally designed for industrialized countries
- global development and manufacturing allow for components and features tailored to local market needs.

3 Conclusions

The product platform approach has proven to be successful for both manufacturers and customers. It is based on a solid theoretical model and its practical application has brought real cost benefits.

The observed trends in the agricultural machinery industry will probably continue to show for quite a few years more, and the concept of product platforms will be leading product development also in the future.

Even more effort will be put on standardization of components and communization of technical solutions, to create new and more extended product families.

Figures 3 to 15 show examples of CNH product families where the product platform concept has been fully applied.

Fig. 3



Fig. 4



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Fig. 5

CNH MXU Tractor

MXU100
MXU110
MXU115
MXU125
MXU135




5 Models, 4 and 6 cylinders mechanically and electronically controlled engines (100-135 hp)
3 drivelines: Mechanical (12x12), Dual Power (24x24) and Semi-power shift (16x16)
4 front axles: 2WD, 4WD light & heavy duty, suspended
suspended

Fig. 6

CNH Utility Range Tractors

CASE IH **NEWHOLLAND** **STEYR**




JX 1060 C	TN 60DA / SA	TN 60A	KOMPAKT
JX 1070 C	TN 70DA / SA	TN 70A	360
JX 1075 C	TN 75DA / SA	TN 75A	370
			375

3 Cyl. N.A. and T.C. diesel engines (60, 70, 75 hp)
Transmission: 8 types of transmission available
8+8 ; mechanical version
16+16 ; mechanical and Power Shift versions
28+16 ; mechanical version
32+16 ; mechanical, HI - LO and Power Shift versions
44+16 ; mechanical, HI - LO and Power Shift versions

Fig. 7

CNH TD Tractor
(for Turkish Domestic Market and Export)

TD 60 – JX 60
TD 70 – JX 70
TD 80 – JX 80
TD 90 – JX 90
TD 95 – JX 95



5 models with two brands
3 engines (60 -95 hp)
6 versions: S/M – 2/4WD –
ROPS - CAB

Same basic driveline
Brand-specific style and features

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Fig. 8

CH TT Tractor for Indian Market

TT 35
TT 42
TT 47
TT 55
TT 75




5 models
3 different engines (35-75 hp)
Two drivelines: 8+2 syncro and 8+2 constant mesh
Different driver environments

Fig. 9

CH CX Combine

CX720
CX740
CX760
CX780
CX820
CX840
CX860
CX880



Separation - Conventional
Grain tank capacity - 7600 to 10500 litres
Engine kW/hp - 170/231 to 275/374

Fig. 10

CH CR Combine

CR940
CR960
CR970
CR980



Separation - Rotary
Grain tank capacity - 9000 to 11600 litres
Engine kW/hp - 220/295 to 315/428

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Fig. 11

CNH FX Series – Forage Harvester

FX30
FX40
FX50
FX60



Engine kW/hp – 265/360 to 329/533

Fig. 12

CNH VM/VL Series – Grape Harvester

VM460
VL610
VL620
VL630
VL640
VL660



Engine kW/hp - 94/128 to 129/175 (4-6 cylinders)
Stainless steel storage tanks – 2100 to 3200 litres tanks

Fig. 13

CNH WDX Series – Self Propelled Windrowers

WDX1002S
WDX1202S
WDX1202
WDX1902
WDX2302




Cutting Methods - Disc and Sickle
Engine kW/hp - 74/98 to 168/225
Cab Platform Shared with AFX Combines

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Fig. 14

CNH HW Series – Self Propelled Windrowers

HW305
HW305S
HW325
HW345
HW365



Cutting Methods - Disc and Sickle
Engine kW/hp - 74/98 to 168/225
Cab Platform Shared with CR Combines

Fig. 15

CNH LBX Series – Large Square Baler

LBX332
LBX422
LBX432



Bale size: 80x90 to 120x90 cm
Pick-up Width: 1.98x2.00 to 2.25x2.40
Tractor Power Requirement: 75 to 90 kW

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