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An inquiry into the ideal mode of existence for Japanese auto parts makers and die and mold production in the future

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1. Introduction

I started my career in the auto industry in the 1980's by joining a Japanese auto maker when only a few could imitate the Euro-American makers. One of these was Toyota who dominated the domestic market and the other was Nissan, which was succeeding overseas due to the durability of its products. Other makers were trying to catch-up by bringing in new products. Mazda made the rotary engine, Subaru developed the horizontally-opposed cylinder engine, Suzuki, with Daihatsu, focused on the Kei automobiles, and Honda brought its Civic to the market.

In the 1990's, Japanese makers were winning in the American market because of the good quality and lower prices of their products, but this provoked complaints from American makers who accused Japan of dumping. This was when Toyota and Nissan started their expansion overseas. Then, many Japanese makers started to move their production overseas to America, Europe, Asia, Latin America, China, and Russia in order to avoid any negative effects from the foreign exchange markets, but this led to less work and empty workshops in Japan, plus the loss of specialist personnel. Entering the 2000's, emission regulations became strict because of the problem of global warming, and we have seen some of the results in the bad practices of VW and Mitsubishi in their efforts to cope with EURO VI. It has also become more difficult to overcome problems with security regulations, like Euro NCAP, even with the auto makers' industrial expertise. In the 2010's, we are now seeing hybrid cars, EVs, and fuel cells to meet the new emission regulations.

Conventionally only the domain of the auto makers, now makers of lithium batteries and fuel cells, and some manufacturers on the west coast of America are entering the auto industry with their new technology, like auto pilots, although this latter technology is more demanding in terms of risk management.

In the meantime, the world of "Monozukuri", the technology of die and mold making for mass production, is still considered important, even though the overall sales of die casts do not cover 10% of the investment in automobile production. This issue is not gaining a lot of attention, but, for Japan globally, die cast makers are finding it difficult to get specialists, new technology and funding.

In this paper, we deal with these issues by analyzing their basis and discussing solutions.

2. The relationship between automobile makers and auto parts suppliers and die and mold makers in Japan, comparing the Japanese and Euro-American cases

For automobiles, since the Ford Model T was manufactured, it has been clear that mass production

is vital. For producing massive volumes of the same quality, die casts are best, although we have examples like Ferrari and Aston Martin which are based on the production of small volumes but are very expensive. These models, though, are distinct from general consumer goods. In this paper, we only discuss automobiles found on the general market, and the maximum price we consider is of that of Daimler's S-Class and Porsche. Even for these small volume and very expensive automobiles, the communization or integration of parts and reduced sizes are becoming two of the main ways to reduce the sales price. In particular, we can state that Porsche is entirely based on this policy, while Daimler is pushing communization through its alliance with Renault and Nissan, as is Porsche with Volkswagen.

Table-1

CY	1980	1985	1990	1995	2000	2005	2010	2015	2016
Toyota	A	A	A	A	A	A	A	A	A
Nissan	B	B	B	B	B&S	B&S	B&S	B&S	B&S
Honda	C	C	C	C	C	C	C	C	C
Mazuda	J	J	J	J	J	J	J	A	A
Subaru	E	E	E	E	E	K	A	A	A
Mitsubishi	F	F	F	F	M	F	F	F	B&S
Isuzu	K	K	K	K	G	G	G	G	G
Suzuki	H	H	H	H	H	H	H	H	H
Daihatsu	A	A	A	A	A	A	A	A	A
Ford	J	J	J	J	J	J	J	J	J
GM	K	K	K	K	K	K	K	K	K
Chrysler	L	L	L	L	M	M	R	R	R
Benz	M	M	M	M	M	M	M	M	M
VW	N	N	N	N	N	N	N	N	N
Audi	N	N	N	N	N	N	N	N	N
BMW	P	P	P	P	P	P	P	P	P
Opel	K	K	K	K	K	K	Q	Q	Q
Fiat	R	R	R	R	R	R	R	R	R
Renault	S	S	S	S	B&S	B&S	B&S	B&S	B&S
PSA	T	T	T	T	T	T	T	T	T
Volvo	U	U	U	U	U	S	S	S	S
Hundi	V	V	V	V	V	V	V	V	V
KIA	W	W	W	W	V	V	V	V	V
Total	18	18	18	18	14	14	14	13	12
Group	5	5	5	5	9	9	9	10	11

Table-1:Groups or alliances among auto makers since 1980. We can see that group businesses and alliances have dramatically increased.

Table-2

CY	1980	1985	1990	1995	2000	2005	2010	2015	2016
Aishin(Toyota)	A	A	A	A	A	A	A	A	A
Jatco(Nissan)	B	B	B	B	B	B	B	B	B
Aichikikai	C	C	C	C	B	B	B	B	B
Univance	D	D	D	D	D	D	D	D	D
Tochigifuji	E	E	E	E	E	F	F	F	F
GKN	F	F	F	F	F	F	F	F	F
ZF	G	G	G	G	G	G	G	G	G
BorgWarner	H	H	H	H	H	H	H	H	H
Magna	I	I	I	I	I	I	I	I	I
Getrag	J	J	J	J	J	J	J	J	I
Total	10	10	10	10	9	8	8	8	7
Group	0	0	0	0	1	2	2	2	3

Table-2 shows the evolution of suppliers as seen through the grouping of transmission units by their components. Here we can discern a trend where part makers are no longer under the control of the big manufacturers.

When the Korean manufacturer – Hyundai (including KIA) – moved into Mexico in 2015 and did not ask their suppliers to follow them, some said this was because of their failure in the US when they had asked their suppliers to go with them. In any case, what is obvious is that obtaining a competitive price and good technology is hard when original ethnic suppliers come to a new country. In reality, Hyundai had an issue with grain in the resin parts that took 5 years to disappear. This was not only because the resin was of bad quality but also because of insufficient know-how. Currently, a Japanese mold X maker is providing dies to Hyundai by working with Hyundai's research institute nearby.

This example shows how complex the development of auto parts is compared to before. The reason for this is regulations like EURO VI and Euro NCAP, and also because of incidents related to these regulations. As a result, relations between auto makers and the die cast makers have become closer than ever before. If this situation continues, it is assumed that after 2025, many medium-sized and small business who are supplying auto parts will face extinction. Also, current auto makers will face a big re-organization on the global scale.

Table-3

unit:1000k yen

No. of worker	No. of company		Turn over	
Under 9	5,925	75.8%	192,053	14.3%
10 to 19	951	12.2%	194,861	14.5%
20 to 29	418	5.3%	162,110	12.1%
30 to 49	252	3.2%	185,543	13.8%
50 to 99	187	2.4%	242,797	18.1%
100 to 199	63	0.8%	167,408	12.5%
Over 200	24	0.3%	197,667	14.7%
Total	7,820	100.0%	1,342,439	100.0%

In Table-3, we show the evolution of auto makers into the future from the viewpoint of die and mold production company in Japan FY2014 total number of 7820 companies, but FY1985 total number of 12200 companies, 40 points down of company.

Tooling is divided into 2 big categories: stamping dies and plastic molding. The former entails both shaping and sintering, and it is more difficult than the latter because the metal can "spring back" to its original shape after folding. The materials vary from the usual type to high tension metals, which can cause various problems. In the same way, there are various sorts of plastics. Tables 4 and 5 give examples of stamping materials and plastic materials, respectively.

Table-4

Matelial code of JIS	Detail
SPCC/SPHC/SECC/SGCC	Steel panel
SUS304-2B other	Stenress panel
SUS304-CSP other	Stenress Spring
A5052P	Aly panel
C1100P/C1020P/C2801P	Cu panel
C5191P/C5210P	Cu/Sn panel
C1720P	BeCuPanel
SK-5/QSK-5	Cu Spring

Table-5

A part of code name & Specific information	
Code	Specific information
PEEK	Poly Ether Ether Ketone
PPS	Poly Phenylene Sulfide
PPSU	Poly Phenyl Sulfone
PSU	Poly Sulfone
PESU	Poly Ether Sulfone
PAR	Poly Arylate
PAI	Poly Amide Imide
PEI	Poly Ether Imide
LCP	Liquid Crystal Polymer
PTFE	Poly Tetra Fluoro Ethylene
PCTFE	Poly Chroro TriFluoro Ethylene
PVDF	Poly Vibylidene DiFluoride

Table-3 right side of number of worker shows the tooling makers for both types of materials. From the table, we can understand that in general these tooling makers are mostly very small businesses. Currently, tooling makers' business models are gradually changing to become auto part makers. Simply speaking, the business of tool making is now hard to manage because for tooling makers, what work is offered is not regular and the price varies, too. In the next few chapters, we discuss the business situation of the smaller tooling makers since major businesses do not usually face the same issues.

3. What can be done in order to be consistent with auto makers' development process? Future trends in the tooling business.

The conventional way to catch up with the auto makers' development process is to work with them continuously for a three-year period because the development of a new car usually takes 3 years. However, recently, due to the rapid development of digital technology, this period has been shortened, which means that the time required to catch up with the competition is now much shorter. Thus, auto makers now have a chance to introduce new technology and carry out cost reductions during the development of new cars. This creates more of a chance for parts manufacturers and tooling makers. However, more is now required of them. For example, if until now cost reductions of 3% were required in 3 years, now 10% will be demanded, and it is assumed that only when a 6% to 10% cost reduction is offered will a parts maker be offered the business.

Another opportunity is that production is possible in many more countries around the world. Businesses are expanding worldwide. For a Japanese maker, it is possible to do business overseas. Although Toyota's business is conducted mainly in Nagoya, and Nissan is in Kanagawa, it can now be anywhere, but this requires a manufacturer to be able to do business 24 hours a day globally. For this reason, those mega-suppliers who can deal with a 24-hour business will beat Japanese makers.

The following is the usual way that a panel supplier obtains the contract to make an auto part.

1. Attend the supplier summit of an automobile maker
2. Attend exhibitions organized by local communities or JETRO.
3. Publish papers in various journals specializing in tooling technology.

4. Visit auto makers to introduce their technologies
5. Attend overseas or global events
6. Make approaches to governments overseas
7. Make approaches to a maker's affiliate or subsidiary overseas.

It is recommended that working through a trading company be avoided. Generally, it is considered that overcoming the barrier of language, culture, etc. needs trading company support, but most auto makers do not like to use trading companies. The same applies to consulting firms as they mean added costs. This is especially the case for foreign capital businesses, as, according to global accountancy law, there is no expense item in the accounting.

The solution lies with the increasing number of foreign students who studying in Japan. We recommend using these students for the knowledge they acquire during their study in the fields of business management, technology, logistics, taxation and financial management. Attention, though, needs to be paid to the their language skills (the recommended level is Level 1 or 2 in the Japanese Proficiency Test as this is the level required for daily communication at work).

Management now regards interpretation services as unnecessary, and businesses are moving away from the conventional idea of using translators or interpreters at work.

The following focuses on the case of tooling makers.

Auto makers are now exhibiting shortcomings due to the impact of mega suppliers of auto parts. In Europe and America, the tooling makers are mostly subsidiaries of the auto makers. In Japan however, tooling makers are independent, and most have succeeded by virtue of their superior technology. According to our investigation, the successors of the tooling companies are chosen from candidates who have experience in the following fields.

・Investment bank experience
・People who have experience in research institutes in foreign countries
・People who changed their career from high technology jobs, such as doctors, or people who are successors in the family business

By contrast, some companies who experienced failure used the following persons:

・Those with only domestic business experience
・People from within the company
・A family relation of the business with a college degree

What is considered important are a wide range of experience, good judgment and language skills.

Following the above discussion on management, we now discuss the technological aspect. For stamping tooling, the level of precision required is very high. For plastic injection molding, most of the major suppliers who own the technology to produce large injection machines are trying to improve the process and the technology. This requires a strong technological basis, which is an asset that has been accumulated by companies with a long history of development and production. We can even see some examples of automobile makers having successfully developed their own tooling machine production overseas.

From a global point of view, there are still many countries who need support in developing their tooling industry, and we have plans to help them, but we have found it difficult to take excellent tooling machines and technology to those countries, one, because of their distance from Japan and, two, because Japan's advanced technology is mostly mastered by an older generation who are not well aware of the current business expansion outside Japan where many chances are being missed. This was also Germany's experience in the past.

Considering this, the authors of this paper have been working with others on cooperation

programs to support overseas countries in the training of specialists. This has potential for the tooling business.

4. The opportunity for tooling makers and their strategy

Japan is famous for its tooling technology but do you know tooling's life cycle? For an electrical appliance, the replacement of parts and after sales service is not fixed so it is not necessary for replacement parts to be manufacture over a very long time, but for automobile parts, replacements are usually available for 10 years after production ends. Also when the next generation's model starts production and ends, the same 10 years are required. In other words, in the case of a model with a life of 4 years, after sales production recycling will last for 28 years while for a model with a 6 year life, it will continue for 32 years.

This requires the efficient management of stock. In Japan, the first project which separated the tooling payment from the part's cost was Nissan Motor's Z-car, and I faced this issue while working on this project at the time.

After that experience, I investigated the use of after sales parts for cars which are out of mass production, together with the sales record per model and the volume required during the life cycle (usually considered to be 10 years according to the market evaluation). The results of this study result are now being used in stock control and are contributing to the estimation of product volumes.

The approach introduced in this paper has not yet been utilized by many automobile companies. Incidentally, it should be noted here that we consider this approach to be applicable only for passenger vehicle production at the moment, not for commercial vehicles.

The business approach introduced in this paper is based on the assumption of an investment of 10 billion JPY.

We believe the approach discussed in this paper will present a useful opportunity for tooling makers when we can get the cooperation of the auto makers for a business management study.

In the future, we would like to have discussions based on a concrete program when one becomes available.