Captive Engineering Centers – Challenges of R&D Localization in Emerging Markets

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Summary

The article deals with the need of Western manufacturers to localize R&D activities in emerging markets. This is primarily due to the shift in both production and sales volumes and intensified by the need to address local market requirements. Selected examples of both OEMs and suppliers were analyzed and critical success factors derived. Illustrated by the successful example of a Korean OEM's market entry in India, recommendations are given for the design and implementation of a local R&D organization. Finally, a conclusion of the most important factors for successfully setting up captive engineering centers in emerging markets is drawn.

1 Introduction

At first, the shift of global production origins and sales volumes to emerging markets will be described. Afterwards, the need of Western OEMs to localize and customize products and processes is explained, using examples from the commercial vehicle industry. This is followed by an overview of R&D facilities and activities of Western manufacturers in emerging markets. As an interim conclusion, the major reasons why Western OEMs shift R&D activities to emerging markets are summarized and various options for execution are discussed. Next, the article takes a close look at important issues to be clarified before local R&D activities can be implemented. Each of these factors will be illustrated using a case study from a Korean OEM, which has successfully operated a local R&D facility in India since 2007. The article will close by summarizing the challenges and success factors for localizing R&D activities in emerging markets.

2 Shift of global production origins and sales distribution to emerging markets

In the future, the majority of the increase in global passenger car sales will take place in emerging markets. China will see the strongest growth, followed by South America (figure 1).

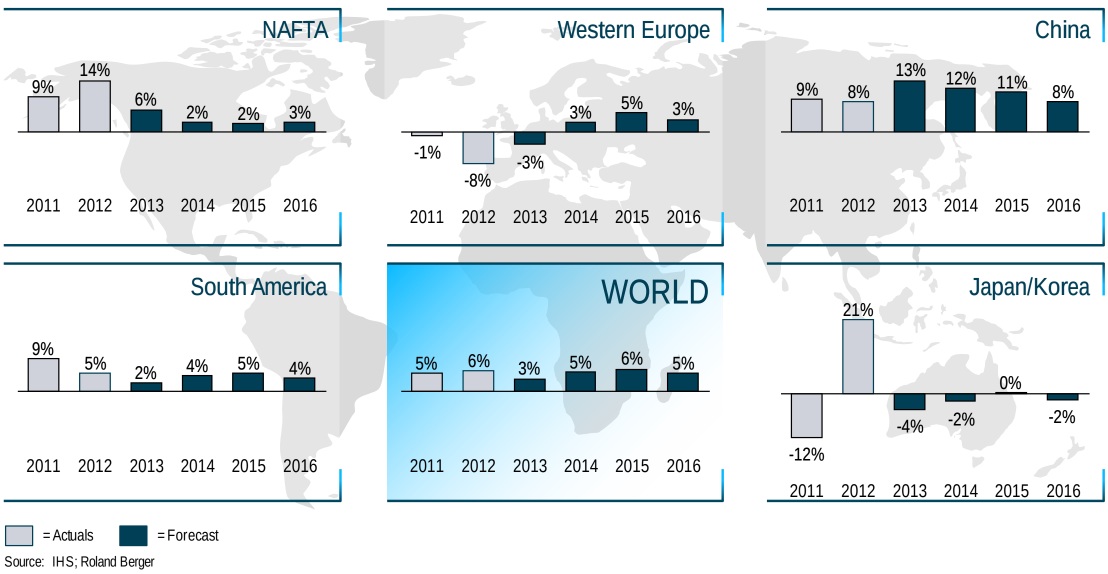


Fig. 1: Development of global sales of passenger cars

This will have a significant effect on the expected sales distribution of Western OEMs. Both European as well as US manufacturers will see their share of sales generated in the BRIC countries shift from currently 21-28% to 27-41% (figure 2). [1]

Additionally, the importance of Western markets as a production hub is declining steadily. The volume of passenger cars produced in Europe as a share of global production decreased continuously from 22% in 2009 to 16% in 2013 (estimation) and will reach around 15% in 2019. A similar picture can be observed for production volumes in the US, which will drop from 13% in 2013 (estimated) to 11% in 2019. At the same time, the production share of the BRIC countries will increase from 22% in 2009 to an estimated 40% in 2019. [1]

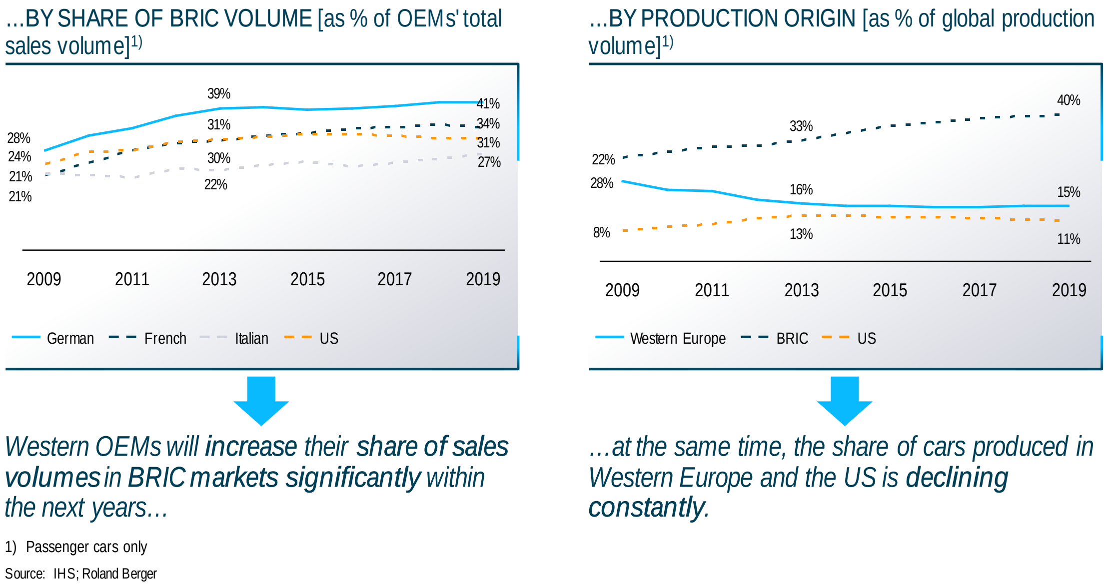


Fig. 2: Development of sales distribution of Western OEMs and global production origins

Therefore, and to participate from this development and the resulting shift of sales growth towards emerging markets, OEMs need to adapt both products and engineering processes to local requirements.

3 Localization and customization

This process of localization and customization of products to emerging market needs can be implemented in 4 steps, each of which offers different cost saving potential (figure 3).

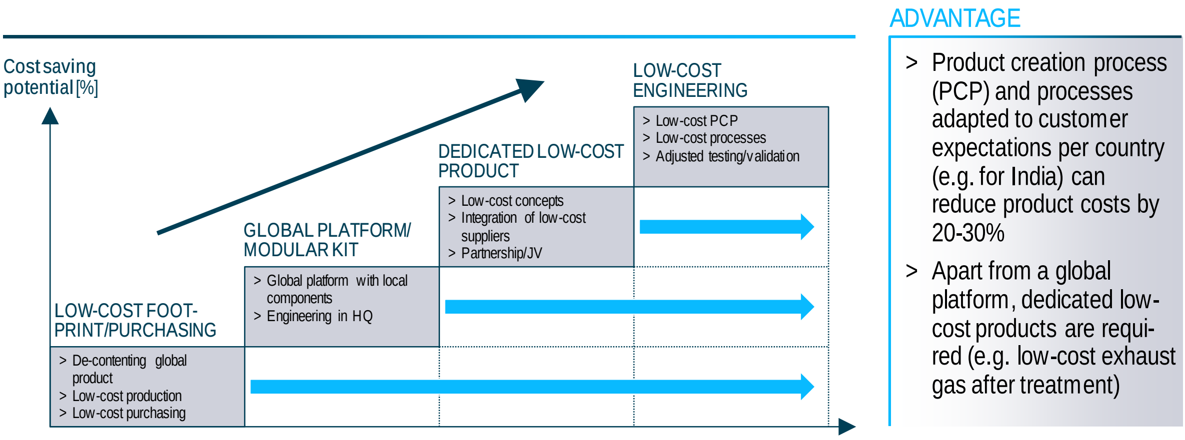


Fig. 3: Localization and customization (example CV India)

Step 1 ("low-cost footprint/purchasing") comprises the de-contenting of global products combined with both low-cost production and purchasing. **Step 2** ("global platform/modular kit") combines a global platform (developed in the manufacturer's headquarters in mature markets) with local components and hence offers the possibility to realize further cost saving potential, e.g. by leveraging scale effects for purchased components. **Step 3** ("dedicated low-cost product") combines designated concepts for low-cost markets with the integration of local suppliers. Very often, partnerships and/or joint ventures with local companies pave the way for a fast and effective realization of such a low-cost product. **Step 4** ("low-cost engineering") offers the highest cost saving potential. In this step, a low-cost product creation process is established which is specifically tailored to the requirements, needs and capabilities of emerging markets. This low-cost development process is backed by additional low-cost processes within the organization, e.g. adjusted testing and validation. This can help cut product costs by 20-30%.

4 Need for local R&D activities and options for implementation

Several factors are driving Western OEMs' need to increase their R&D presence in emerging markets. Numerous Western OEMs have already increased their R&D presence there – especially in China, India and South America. Figure 4 gives an overview about their activities.

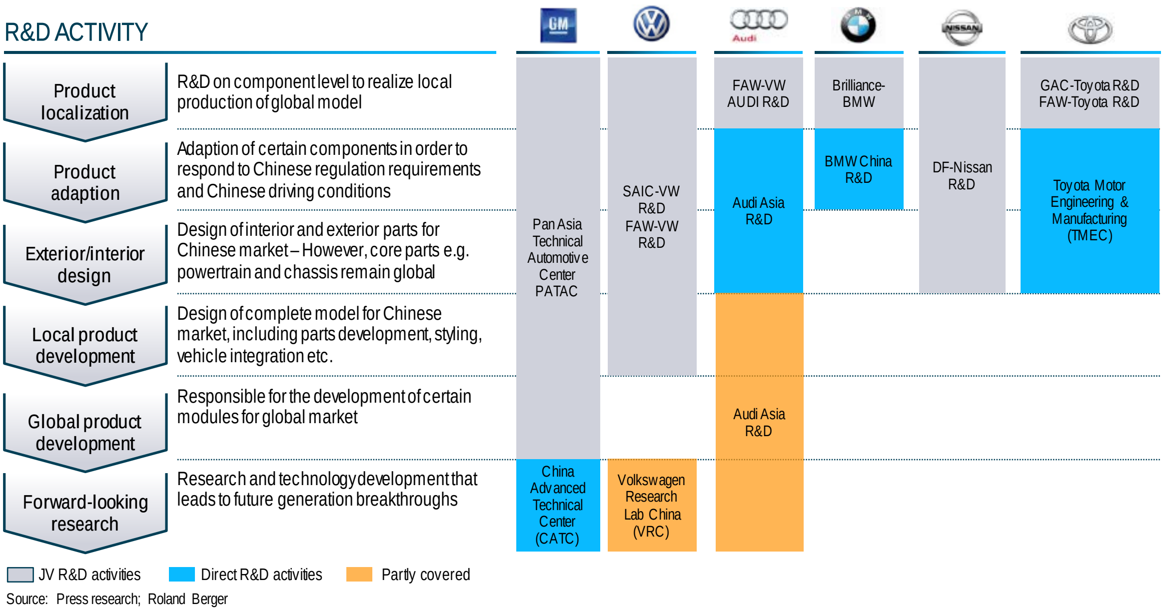


Fig. 4: R&D activities of major automotive OEMs in China

The reasons for OEM to increase their presence are manifold. On the one hand, emerging markets have become a **major global automotive powerhouse** and are increasingly gaining importance as a hub for innovation (e.g. driver assistance systems). On the other hand, emerging markets **strongly differ from established Western markets** and are characterized by specific requirements, resulting in the need for local adaptation and customization. At the same time, Western OEMs are facing **increasing cost pressure** in emerging markets due to the rapidly improving ability of emerging market players to compete for customers, e.g. a sharp increase of quality standards at low price levels. Furthermore, **greater complexity** and **increasingly shorter product lifecycles** make it necessary to adjust products to specific customer needs in emerging markets over a short period of time. Finally, **local regulations** (e.g. emission requirements) additionally demand market-specific product offerings and have significant impact on the required flexibility of the global R&D organization.

All these factors are pushing Western OEMs to establish local R&D activities in emerging markets. Generally, this can be done in two ways: a **collaboration with engineering service providers** or the **set-up of an own captive engineering center**. At least at first, collaborating with an engineering service provider might be a fast and cost-effective way to cover local market needs. However, some severe risks arise in the mid- and long-term. Firstly, the security of critical know-how cannot be guaranteed when partnering with a (local) engineering service provider. Knowledge, especially in R&D, will become ever more important as a competitive factor for differentiation, and so this lack of security poses a significant risk for OEMs – especially as it concerns know-how about future growth markets. Moreover, working with an engineering service provider does not offer the same opportunities a local R&D organization can for building up and sharing knowledge with the global R&D organization. Only a wholly owned, local R&D organization will pave the way for global knowledge sharing with emerging markets and provide an adequate link to global structures. It also makes it possible to keep critical know-how within the organization. For these reasons, **establishing a captive engineering center** is clearly the better way for Western OEMs to localize R&D activities and build up know-how in emerging markets (figure 5).

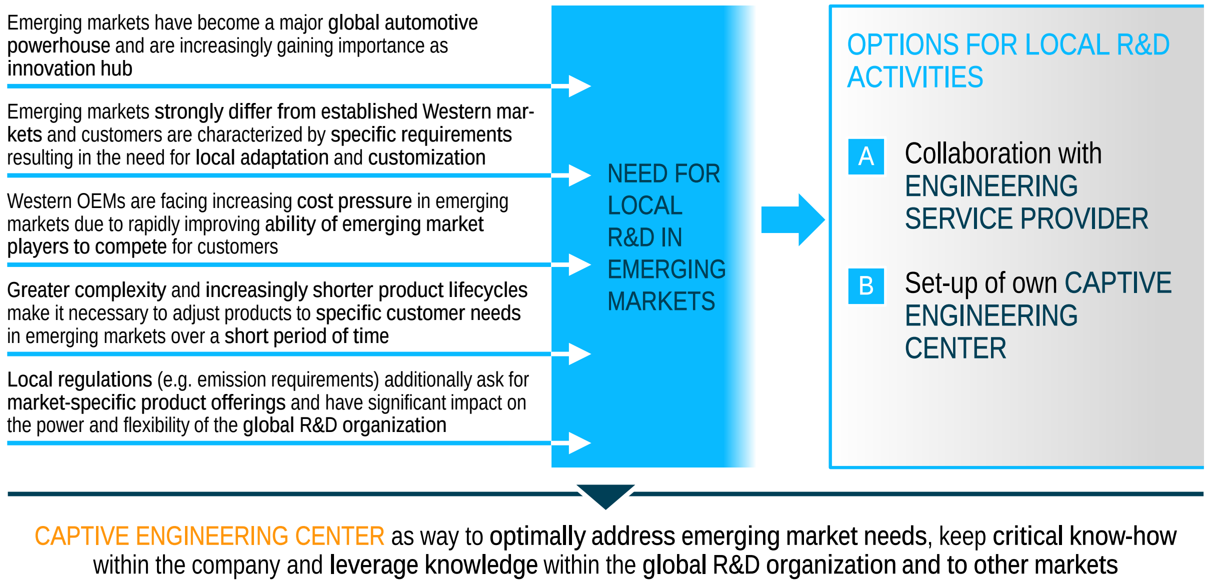


Fig. 5: Need for local R&D activities and options for implementation

5 Issues to be clarified for the successful development of local R&D centers

After an OEM's decision for setting up a local R&D center in emerging markets, several issues need to be addressed to ensure a successful implementation (figure 6).

First, the **business scope** of the local R&D activities must be clearly defined and aligned with central R&D as well as other global R&D departments. This makes it possible to clearly allocate responsibilities and avoid duplicate work. The company must also make sure that R&D activities match local competencies and thereby make use of the organization's capabilities in an optimum way.

After defining the business scope for local R&D activities, a specific **R&D center setup** should be fleshed out. The steps required to establish a local R&D center must be identified and a concept for the overall organizational structure must be developed, which also includes the specific functions to be covered by the local engineering center. The setup and structure of the R&D department will support the implementation and task fulfillment defined as part of the business scope definition.

Furthermore, the **position and role** of the R&D center must be clearly defined. This includes its positioning in the OEM's global network as well as the integration into the global R&D organization (e.g. development activities for other markets). It is thereby linked directly to the definition of the business scope. Additionally, coordination processes with the global R&D organization must be defined, including proven structures, communication processes and the clear assignment of responsibilities. Moreover, dedicated functions should be installed to support the integration of local R&D into the global R&D organization (e.g. assignment of expatriates and roadmaps for knowledge transfer).

Finally, a detailed roadmap for the **implementation** of the local R&D center must be developed. This includes the sizing of the local R&D center as well as clear targets for the share of local employees vs. expatriates from other global R&D facilities. Additionally, further business impacts should be considered as well, e.g. the localization of other functions in the course of the localization of R&D activities.

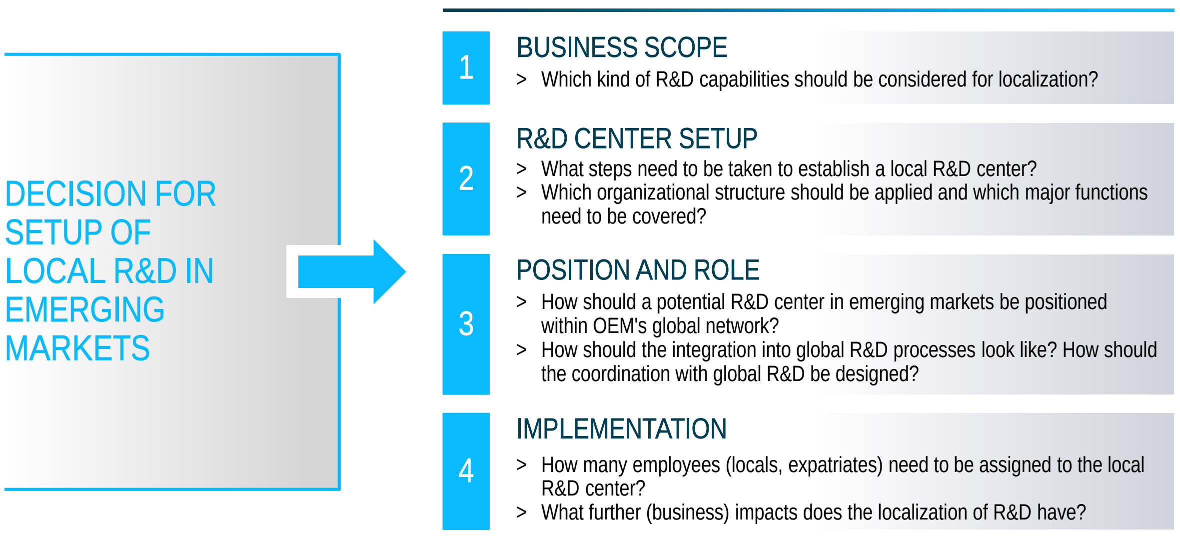


Fig. 6: Issues to be addressed for developing engineering centers in emerging markets

To give an example about how OEMs can successfully build up local engineering centers in emerging markets and integrate them into their global R&D organization, we analyzed the captive engineering center of a Korean OEM in Hyderabad. By referring to the issues identified above, this example gives insights into the most important factors for a successful implementation.

6 Case study: Engineering localization in India

The Korean OEM has operated its R&D center in Hyderabad since 2007. As one of 8 global R&D centers and the first in Southeast Asia, it serves as the global hub for the engineering and development of all small-size cars globally. In 2012, the center employed approx. 580 local engineers, additionally supported by approx. 10% expatriates. Activities covered at Hyderabad include content development, adaptation for domestic to overseas markets as well as styling, design engineering and vehicle test and evaluation. An example for the successful implementation of local R&D activities and their integration into global business operations is the Hyundai Eon model, which was completely developed by Hyundai's local R&D team. [2]

6.1 Business scope

The R&D Center in Hyderabad is structured into 8 departments with clearly and specifically assigned activities (figure 7).

DEPARTMENT	ACTIVITIES
Powertrain	> Hexa and Tetra modeling for powertrain components
Electrical and electronics	> Trouble shooting sensors & electrical system > Support wire harness design
Computer-aided engineering (CAE)	> Crash testing > Complete deck preparation > Torsion and bending analysis > Interior impact analysis > Frame stiffness and sagging analysis
Computer-aided styling (CAS)	> Master skin creation > Design and color suggestions
Product engineering	> Research on customer needs

DEPARTMENT	ACTIVITIES
Body in white (BIW)	> Concept generation and packaging > Full vehicle integration, complete deck preparation > Post processing results, creating system level, development of parts tolerance studies on manufacturability, workability, durability
Chassis	> Design change of existing components > Preparing assembly drawings > Creating BOM and releasing drawings > Modeling of chassis assembly for durability analysis > Modeling of suspension assembly
Trim	> Master section design according to concept > Skin creation > Regulation and package checking > Creation of solid models for consideration of manufacturing feasibility

Source: Press research; Roland Berger

Fig. 7: Activities of Korean OEM's R&D center in Hyderabad by department

The **powertrain** department handles hexa and tetra modelling for powertrain components. The **electrical and electronics** unit covers trouble shooting for sensors and electrical systems as well as support for wire harness design. Employees in the **computer-aided engineering (CAE)** unit are responsible for crash testing and complete deck preparation. The also conduct various analyses (torsion and bending, interior impact, frame stiffness and sagging). The **computer-aided styling (CAS)** department supports master skin creation and provides design and color suggestions. The **product engineering** department covers all aspects regarding research on customer needs. The **body in white (BIW)** department deals with all issues concerning concept generation and packaging, full vehicle integration and complete deck preparation as well as post-processing results. BIW also provides parts tolerance studies on manufacturability, workability and durability. In the **chassis** department, design changes of existing components are made, assembly drawings are produced and bills of material (BOM) as well as release drawings are created. It also models both chassis assembly (for the conduction of durability analyses) and suspension assemblies. The **trim** unit covers master section design, skin creation, regulation and package checking as well as the creation of solid models for considering manufacturing feasibility.

6.2 R&D center setup

The **organizational structure** (figure 8) shows the 8 units of the Indian R&D center. The approx. 580 engineers described above are distributed over the body in white (BIW), trim, chassis, powertrain, electrical and electronics, computer-aided engineering (CAE), computer-aided styling (CAS) and project engineering department. An additional 10% are expatriates from central R&D in Korea who support the local team across the different functions.

Taking a closer look at the **functional break-up** of the organization, nearly half of the employees (45%) work in analysis. Another 35% work in design, while 15% of the overall engineering staff focus on car styling. 5% of the engineers are involved in project management.

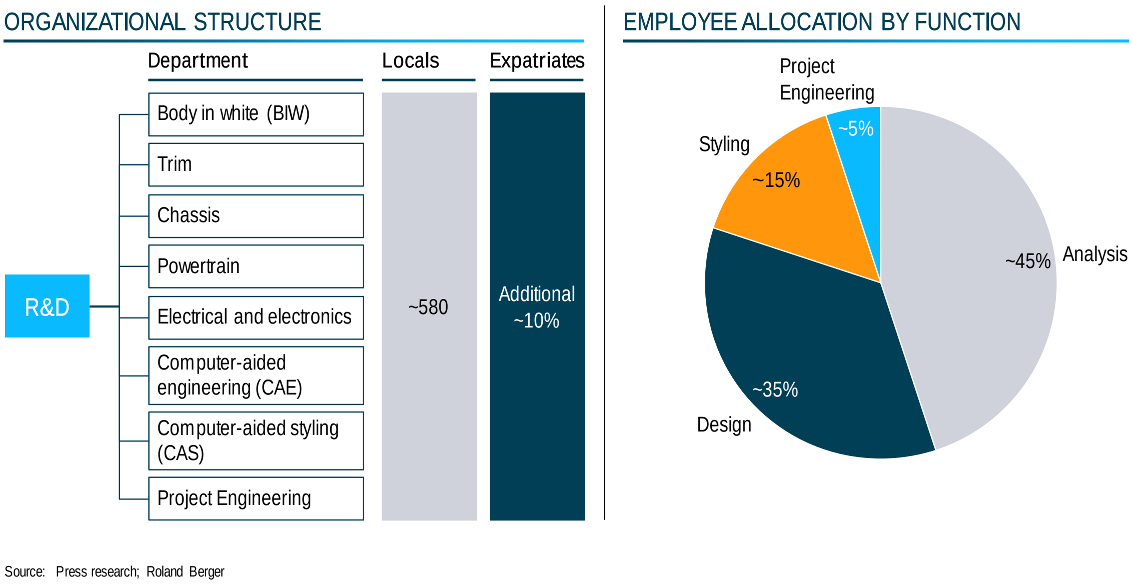


Fig. 8: Organizational structure and employee allocation by function

6.3 Position and role

Besides a clearly defined local R&D organization in India and the local and international capacities provided, a close cooperative relationship between central R&D and the local R&D center in India has been worked out and implemented (figure 9). This enables close coordination and thereby effectively integrates Hyderabad into the global R&D organization.

Each project team in India usually consists of 4 to 5 engineers or trainees (so-called Graduate Trainee Engineers, or GTE). A Section Head, who is supported by one or more Assistant Managers, helps coordinate the different engineering projects. This team directly reports to engineers in the central R&D center in Korea. Coordinators are installed as facilitators between the Korean and the Indian R&D teams and provide guidance on day-to-day working issues. For any work involving other global R&D centers, the request is routed through the Director, who is in charge of the respective Heads of Department. Both the Heads of Department and the Coordinators finalize the team involvement of the Indian employees who work directly with R&D engineers abroad and take up design activities accordingly. The role of expatriates is to support local employees' development through mentoring programs and facilitate close interaction with the global organization.

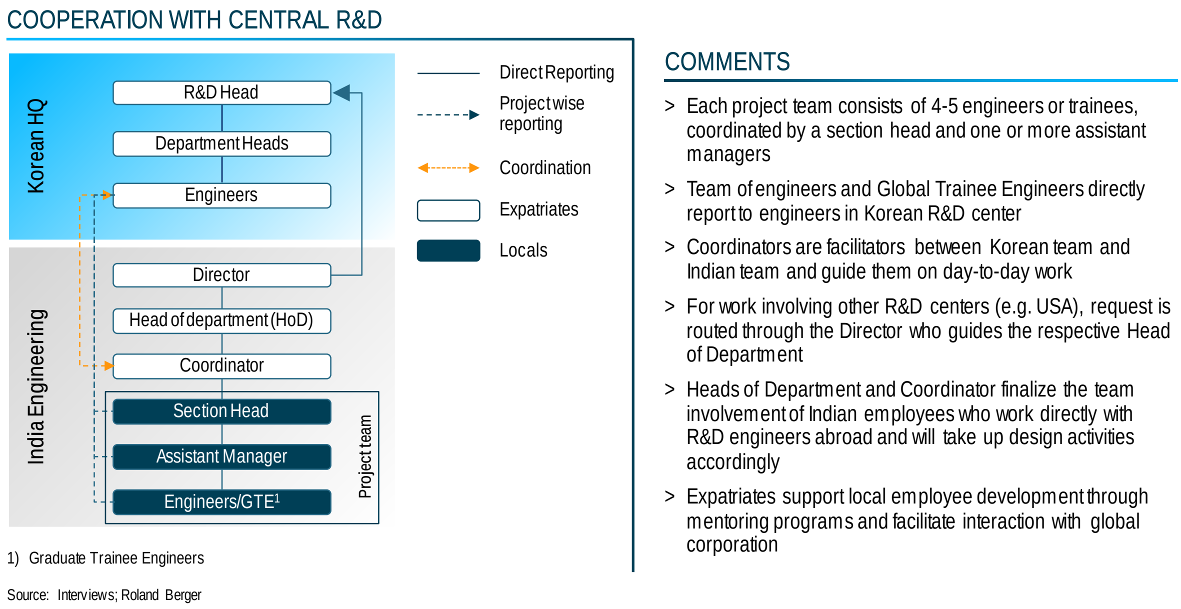


Fig. 9: Interaction between local and central R&D

This concept enables a close link of the local R&D department in India to the global R&D organization, coordinated by central R&D in Korea. It ensures a steady knowledge exchange among the various global R&D departments and makes it possible to optimally leverage know-how within the global organization. Furthermore, steering and coordinating global R&D activities centrally allows them to avoid duplicate work and best integrate local competencies into the global organization.

6.4 Implementation

The implementation of the R&D concept was supported by consistently increasing local R&D staff (figure 10). After starting out with 140 local engineers in 2007, the R&D center in Hyderabad has approx. 580 local engineers and an additional 10% in expatriates (in 2012). The major role of the international expatriates comprises mentoring local engineers, facilitating interaction between local and Korean R&D teams and the coordination of the team involvement whenever local R&D engineers work with the global R&D team on design activities.

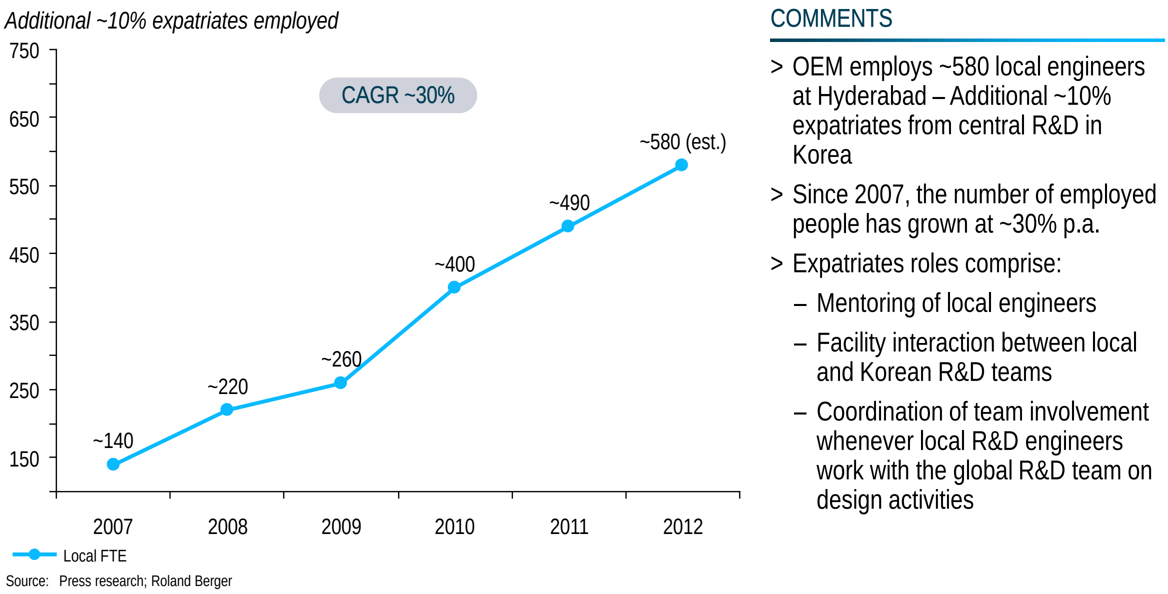
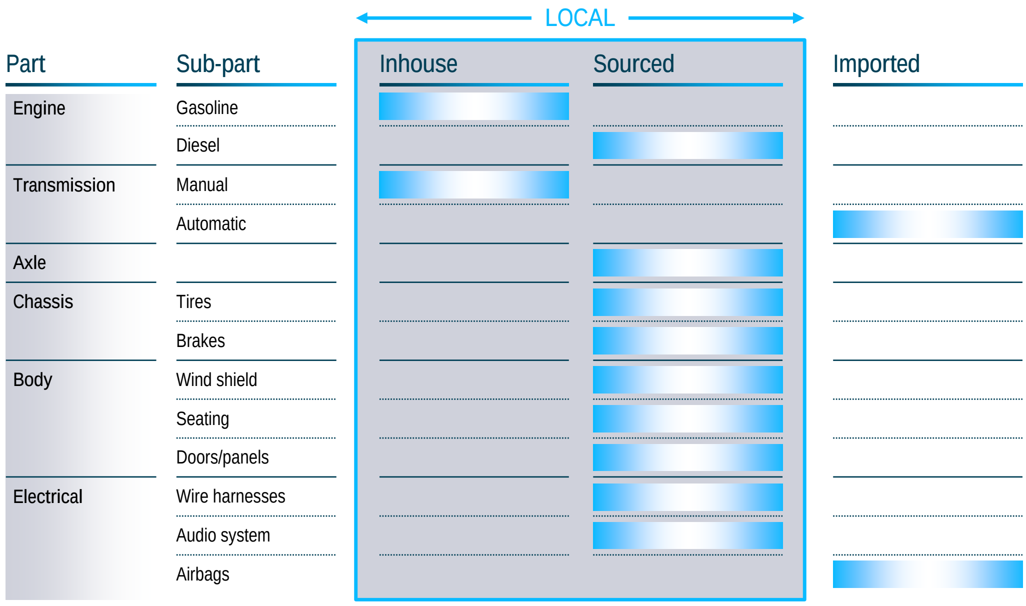


Fig. 10: Employee development of the captive Indian R&D center in Hyderabad

Besides an adequate ramp-up of the local R&D organization in terms of capacity and integration into global R&D, further business impacts play an important role and hence need to be considered. The localization of R&D typically goes hand in hand with an increased level of local sourcing of components, as figure 11 illustrates.



Source: Press research; Roland Berger

Fig. 11: Localization of sourcing for specific components in India (example volume model of Korean OEM)

7 Conclusion

Companies setting up local R&D organizations have to face some serious challenges. However, these can be countered by bearing in mind several success factors (figure 12).

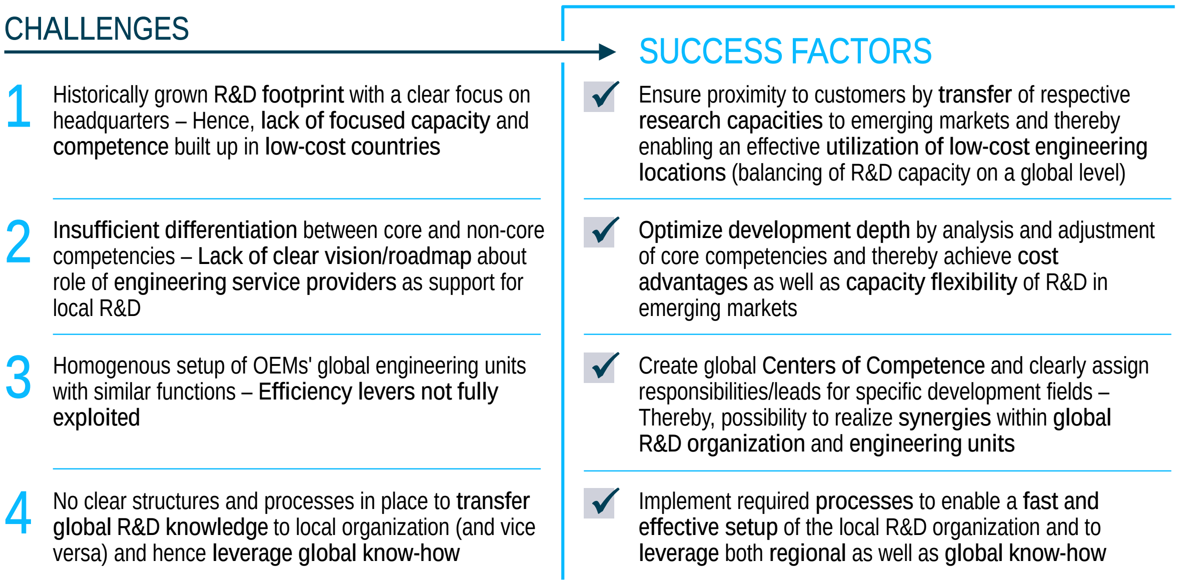


Fig. 12: Challenges and success factors for setting up local R&D centers

One major challenge is the **historically grown R&D footprint** of Western OEMs with a clear focus on headquarters. This leads to a lack of focused capacity and competence built up in low-cost countries. As the global growth regions already shifted from Western towards emerging markets, manufacturers need to ensure a distinctive proximity to the customer base. They therefore need to transfer respective research capacities to emerging markets in order to effectively utilize low-cost engineering locations and thereby balance their R&D capacity on a global level.

Moreover, an **insufficient differentiation between core and non-core competencies** can often be observed. Due to the lack of a clear vision/roadmap about the role of engineering service providers as supporting function for the local R&D team, no market-specific capabilities can be established by the local R&D organization. This in turn prevents them from adopting an adequate role in the global R&D landscape. By analyzing and adjusting core competencies to optimize development depth, cost advantages can be achieved and capacity can be made more flexible. Besides that, a clear positioning of the local R&D team can be achieved.

Additionally, a **homogenous setup of OEMs' global engineering units** with similar functions means that efficiency levers cannot fully be exploited (e.g. duplicate work). This can be overcome by creating global Centers of Competence with clearly assigned responsibilities and leads for specific development fields (e.g. R&D center in emerging market is responsible for the development of global low-cost cars). Thus, the active leverage of specific know-how acquired in different regions and countries can be enabled. Another benefit is that it helps to realize synergies within the different engineering units and the global R&D organization.

OEMs establishing local R&D capacity also have to contend with a **lack of clear structures and processes** for transferring global R&D know-how to the local organization and vice versa. Implementing the right set of processes enables to rapidly and effectively set up local R&D activities as well as leverage both regional and global know-how.

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