Managing Global Networks: an empirical study of Ferdows factory role

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Abstract
In the current global economy, with an increased international presence of all type of organisations, the design and management of global operations networks (GON) play a vital role in organisational competitiveness. In order to deal with this complex production networks, it is necessary to provide business managers a useful guideline to face the internationalization process in an effective way. The aim of this paper is to discuss the development and evaluation of a construct for assessing the strategic plant role and developing an improvement roadmap in GONs. This research makes a contribution to current knowledge on global operations by extending the model proposed by Ferdows (1997a) and operationalising it to enable its application for the design and optimisation of global operations networks.

Keywords: global operations, internationalisation, plant role

Introduction
As a result of the internationalisation trend and in order to take the opportunities that exist in markets worldwide, companies of all types have now a global presence (Veerecke, 2007). This has created a new set of organisational challenges that require attention and answers from the academic community. As a consequence of the economic globalisation the design of global operations networks (GON) will increasingly need to cover multiple regions and cope with higher network complexity (Shi and Gregory, 1998; Ernest and Kim, 2002), connecting markets to global supply and manufacturing sources beyond any geographical border. However, the literature on global operations network design and management is still scarce and fragmented (Corti et al., 2009; Laiho and Blomqvist, 2010).

An interesting proposal was presented by Ferdows (1997a), who stated that the management of GON could be carried out based on the strategic plant role concept. However, there are few evidences of empirical testing of Ferdows’ model and the deployment of the strategic plant role concept to an operational level (Veerecke and Van
Dierdonck, 2002; Mediavilla and Errasti, 2010). As a result, any attempt to design and/or restructure a GON is difficult to put into practice, as the plant role concept is complex to formulate, deploy and prioritise. This is paradoxical as the higher the role the lower chance for a plant to disappear from the GON (Vereecke, 2007). With the current degree of globalisation, inefficient plants can no longer survive even in distant local markets (Mefford and Bruun, 1998).

This paper explores the application of Ferdows’ model for the analysis of strategic plant roles in a GON and extends the scope of this model by discussing a framework for deploying an improvement roadmap, which facilitates the strengthening of capabilities of individual plants and a gradual upgrade of their strategic role within a GON.

Literature Review

In the current global competitive environment, it has been stated that building and managing a GON is widely recognised as one of the most important challenges within international operations management (Ferdows, 1997a; Ferdows, 1997b; De Toni and Parusini, 2010; Netland, 2011). Evolving from an independently managed (or with lower interaction) plant network to a coordinated manufacturing network allows benefiting from the synergy among the plants (Dubois et al., 1993; Shy and Gregory, 2005) by improving cost and delivery performance and enhancing the learning curve from the experiences of partners in the network (Flaherty, 1986). However, the process and practice to optimise the overall performance of the operations network is still not well understood (Rudberg, 2004). Defining and managing the roles of individual plants is a critical component for optimising the performance of GONs because this enables the alignment of the business strategy with operations across the network (Shi and Gregory, 2005). The optimisation of a GON is dependent on the specialisation of activities and capabilities that individual plants within the network develop (Ferdows, 1997a; Maritan et al., 2004). It is therefore important to align the way in which each plant is managed with the requirements of the entire network.

In this context, building and managing a GON is widely recognised as one of the most important challenges within international operations management (Ferdows, 1997a; Ferdows, 1997b; De Toni and Parusini, 2010; Netland, 2011).

In the past, a common internationalization approach was to look for short-term cost reduction and competitiveness and resulted in the establishment of foreign plants to benefit from the cost advantages of a particular location (e.g. tariff and trade concessions, labour cost, subsidies, etc). As a consequence, these plants had a limited range of responsibilities, autonomy, network participation and resources assigned to them (Ferdows, 1997a). However, many organisations expect the benefits of individual plants within the network to go beyond the cost orientated incentives, including access to markets, customers and suppliers or specifically skilled, talented and motivated workforce. These factories will have a wider range of responsibilities in addition to production work including product or process engineering, purchasing decisions, after-sales service, etc. (Ferdows, 1997a).

The questions that still remains unanswered in the multisite production configuration is how to deploy the operations strategy in a multi-location GON and, in particular, how to balance the different competences and responsibilities of individual plants within the network, taking into account that the each plant could develop capabilities specific for
that plant or used by the whole GON. Cheng et al (2011) state that most of the debate around plant roles has been focused on the advantages of location and competencies of individual plants without understanding its influence on the entire GON. It is therefore necessary to study the development of individual plant roles and the interactions with the evolution of the wider network.

Ferdows stated that “superior manufacturers gain a competitive advantage by methodically upgrading the strategic role of their plants abroad” (Ferdows, 1997a, pp. 73). He proposed a model that identifies different strategic roles that plants within a GON can fulfill and provided a development path to increase the competencies of individual plants in pursuit of higher strategic roles.

Whilst Ferdows’ work provides a useful starting point for designing or re-structuring the operations of plants within a GON there is little evidence of the application of the model beyond the work by Vereecke and Van Dierdonck (2002). This particular study discusses the application of Ferdows’s model to the decision making process of establishing and/or acquiring a new production unit. However, it does not look into how the competencies of the production units within the existing network can be developed to enable the adoption of a higher level strategic role.

In order to generate new insights into the application of the model further empirical research is required (Chakravarty et al., 1997; Netland, 2011). Furthermore, it is clear that more research is needed to understand the evolution and coordination of the operations of individual production units within a network of manufacturing facilities (DuBois et al, 1993; Shi and Gregory, 1998; Shi and Gregory, 2005, Cheng et al, 2011). Models and techniques to aid practitioners formulating and developing operations strategy when designing or restructuring a GON are lacking (Vereecke and Van Dierdonck, 2002) and the study areas are dispersed (Corti et al., 2009; Laiho and Blomqvist, 2010), which results in difficulties to renew competences and capabilities of individual facilities (Teece et al, 1997; Sweeney et al., 2007). Finally, there is limited research on the improvement programs and intra-firm practice transfer in multinational manufacturing enterprises with GONs (De Toni and Parusini, 2010).

In summary, the new paradigm in global operations strategy is the need for continuous reconfiguration of the manufacturing systems and operations of a GON to adapt to a dynamic environment. The ability to quickly and effectively reconfigure the operations of the plants within the GON is then a key source of competitive advantage. The questions that still remain unanswered in these regards are (1) how to balance the strategic roles, competencies and responsibilities of multiple plants within a GON and (2) how to deploy the operations strategy within a GON where individual plants require to simultaneously and continuously develop their capabilities to remain competitive.

This paper proposes a framework called “Akondia” for the empirical application of Ferdows’ model and discusses its implementation within a multinational white goods manufacturer. The findings of the study extend the current knowledge in the area by defining how to upgrade a plant’s strategic role within the framework of a GON, beyond the sole analysis of the current strategic role.

**Methodology**

The research team employed action research (AR) as the main methodological approach to carry out this study. This research study was carried out over a 10 month period
between 2009 and 2010. The company where the study took place is a corporate group operating worldwide and dedicated to the design, production and distribution of white goods. The company posted above 8 billion Euros in 2009 and is one of the leading companies in the sector worldwide. Its operations network is composed by more than 40 factories operating in Europe, the USA, Latin America and Asia, with a workforce of approximately 40,000 people.

The aim of AR is to contribute to academic research while contributing to solving practitioners’ problems with the research(s) being actively involved in the process of change (Eden and Huxham, 1996; Coughlan and Coghlan, 2002; Vignali and Zundel, 2003). Operations management research often requires learning from application and as such AR has become a more widely used approach for this discipline (Westbrook, 1995; Coughlan and Coghlan, 2002).

Since one of the objectives of this study was to develop a framework (or construct) to make Ferdow’s model operational the principles of constructive research were adopted to complement the AR process. Constructive research is a research approach that aims to produce solutions to explicit problems (Kasanen et al, 1993) and it is closely related to the concept of innovative constructivism (Meredith, 1993). This approach produces an innovative solution, which is theoretically grounded, to a relevant practical problem. An essential component of constructive research is the generation of new learning and knowledge in the process of constructing the solution (Mendibil and Macbryde, 2005). The quest for theoretical novelty, link to existing theory and discussion over the applicability in other situations distinguishes this research approach from product development and problem solving initiatives (Lanning, 2001). Kasanen et al (1993, p.246,) suggest that a good quality construct has the following characteristics:

- Practical relevance
- Practical utility / proved to be useful
- Link to theory / theoretically grounded
- Theoretical novelty
- Applicable in other environments

Constructive research can be seen as a form of applied research and as such, a key criterion for judging the quality of the research is to do with usefulness (Kasanen et al, 1993). It is important for the final output to be relevant, simple and easy to use (Lanning, 2001). This means that although rigorous research is required for enhancing credibility, there is also a need for developing standards of practical relevance. Therefore, a group of practitioners needs to be identified in order to apply the construct and receive adequate feedback (Lanning, 2001; Mendibil and Macbryde, 2005).

The ‘Akondia’ framework presented in this paper was developed and evaluated by a team of employees and academics. The researchers used key pieces of existing research work (e.g. Ferdows, 1997; Vereecke and Van Dierdonck, 2002; Porter, 1985) and internal benchmarking methods utilised by the company (e.g. lean based production systems, purchasing excellence programs, supply chain standards, etc.) as the basis for the development of the framework. In addition, an assessment tool in the form of a questionnaire was created to enable the evaluation of the capabilities of individual plants within the network. Finally, to support the refinement, evaluation and validation of the framework the research team facilitated two Delphi studies (or expert panels). The next section will discuss these elements in more detail.
Figure 1 summarises the different phases, activities and outcomes of this research study.

**Making Ferdow’s work operational: The ‘Akondia’ framework**

The proposed framework called ‘Akondia’ is the proposal for solving one of the three core challenges exposed on GlobOpe Framework (Errasti, 2013; Martínez, 2013) exactly for the challenge named “Multi-site Production Network Configuration”. Additionally, the other two challenges related to global operations configuration that GlobOpe Framework encloses are “New Facility Implementation” and “Global Suppliers Network Development” (see Figure 2).
Anyhow, focusing on ‘Akondia’ framework, it aims to facilitate the practical application of Ferdows’s model and to extend its application by defining how to systematically upgrade the strategic role of a plant within a GON. Depending on the scope of analysis the ‘Akondia’ framework contributes to the continuous optimisation and sustainability of (1) the GON (by identifying strengths of each network unit and prioritising the development of competences from a network perspective) or (2) individual units (supporting plants to strengthen their capabilities and potentially upgrade to a higher value added plant role).

Prior to developing the ‘Akondia’ framework the authors had discussed in two previous papers the usefulness of the lean production based models for assessing the plant role suggested by Ferdows (Mediavilla and Errasti, 2010; Mediavilla et al., 2011). This analysis showed that lean management models had significant limitations for operationalising Ferdows’s strategic plants roles. Therefore the main research motivation for the ‘Akondia’ framework is to find a systematic method for assessing and improving the competencies of a plant or a GON based on the Ferdows’ plant role model.

The ‘Akondia’ framework is divided into four stages. The following table provides an overview of each stage of the process:
Table 1- Stages of the ‘Akondia’ framework

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<th>Stage</th>
<th>Purpose</th>
<th>Who is involved</th>
<th>What to do</th>
<th>Support tools</th>
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| **Stage 1: Assess the competencies of the plant** | To carry out an assessment of the plant’s competencies based on Porter’s value chain model | Researchers, Business unit management team, Local Management of the plant | 1. Interview business unit management team  
2. Interview plant management team  
3. Plot results in appropriate graphical format | Structured questionnaire based on Porter’s value chain model |
| **Stage 2: Develop generic profiles for all strategic roles** | To identify the required and recommended competencies for each strategic role as defined by Ferdows and define their maturity level | Researchers, Business unit management team | 1. Delphi panel  
2. Plot generic profiles in appropriate graphical format | Delphi panel results  
Competency assessment results |
| **Stage 3: Define the plant role** | To define the plant’s role based on the analysis of the competency assessment | Researchers, Plant management team | 1. Compare the generic plant role profiles with the results from the competency assessment  
2. Define plant role based on closest match to generic plant role profiles | Generic plant role profiles  
Competency assessment results |
| **Stage 4: Define an improvement roadmap** | To define an improvement roadmap to strengthen the competitive position of the GON or individual plant | Researchers, Business unit management team, Plant management team | 1. Define improvement roadmap to strengthen current plant role  
2. Define improvement roadmap to adopt a new plant role | Graphical prioritisation matrix (competence level and influence level)  
Relevant improvement models and tools to support specific competence development needs |

**Discussion and conclusions**

In order to evaluate the validity of the findings and the quality of the research it is important to compare the work carried out in this research project with the criteria defined for evaluating the quality of constructive research (Kasanen et al, 1993). As Table 5 shows this research meets all criteria required for good quality constructive research. The main limitation of the study is related to the validation of the applicability of the framework in other environments. During this study the framework was applied in a multinational company acting in a particular sector. Extending the study to other companies with multiplant networks and different sectors would significantly increase the validity of the framework. Having said that each stage of the framework was developed with the generalisability of the framework in mind and therefore the research team is confident of its application in most manufacturing GONs.
Table 2- Evaluating the quality of the research

| Practical relevance | More research is needed to understand how to coordinate the operations of individual production units within a network of manufacturing facilities (DuBois et al, 1993; Shi and Gregory, 1998; Shi and Gregory, 2005). Models and techniques to aid practitioners formulating and developing operations strategy when designing or restructuring a GON are lacking (Vereecke and Van Dierdonck, 2002) and the study areas are dispersed (Corti et al., 2009; Laiho and Blomqvist, 2010), which results in difficulties to renew competences and capabilities of individual facilities (Teece et al, 1997; Sweeney et al., 2007). There is limited research on the improvement programs and intra-firm practice transfer in multinational manufacturing enterprises with GONs (De Toni and Parusini, 2010). |
| Practical utility / proven to be useful | The results of the case study were extensively discussed via delphi panels and personal interviews with HQ and local plant managers, which confirmed the practical utility of the ‘Akondia framework’. Evidence from the evaluation shows that the two objectives for assessing the usefulness of the Akondia framework (i.e. Accuracy and quality of the identification of the current strategic plant role; accuracy of the improvement roadmap for developing higher value plant roles) were met. |
| Link to theory / theoretically grounded | Mainly influenced by work from Ferdows (1997a) and Porter (1985). Authors have previously presented initial findings in other publications |
| Theoretical novelty | The novelty of the Akondia framework stems from extending the previous work by Ferdows (1997a) by proposing a step by step process to identify plant roles within a GON and developing a improvement roadmap to upgrade their competencies. |
| Applicable in other environments | The authors consider that the ‘Akondia’ framework can be extended to other sectors or companies. The only partial adaption could be related to the generic strategic profiles – which should be executed for other environments. |

The research study discussed in this paper provides several key conclusions:

- The ‘Akondia’ framework enables making Ferdows’s strategic roles operational by focusing on the competencies of different areas of the value chain. Only assessing supply chain and production related aspects would lead to an incomplete plant role analysis.
- Each of the strategic plant roles defined by Ferdows contains a clearly identifiable set of ‘must’ and ‘recommended’ competencies for different aspects of the value chain. Whilst there might be commonalities when developing generic profiles for each strategic role these competencies are specific to the context of application (e.g. company, business unit).
- All the assessed plants have a clearly dominant affinity to one of the Ferdows strategic location advantage types (“low cost production”, “Skills and knowledge” and “proximity to market”) and therefore to a certain plant role. However, all plants have a certain grade of affinity to most of the other plant roles, which indicates a certain hierarchical order within the plant roles.
- The assignment of competences within a GON has a systemic nature, which does not allow the plants to decide independently. The influence grade per competence shown in the ‘Akondia’ framework could provide an interesting point for joining corporate and operations strategies to operational decisions regarding competence assignment.
- The ‘Akondia’ framework provides a structured improvement path for each plant that wants to reinforce its role within a GON, first by stabilising the current assigned role followed by gaining additional competences.
- The contribution that this research makes stems from defining a process for GON optimisation by assessing the strategic role and improving the competencies of
individual plants within a GON. This is achieved by enabling the integration of existing GON and value chain models (e.g. Ferdows, Porter) with relevant operational improvement methodologies (e.g. Lean, SCOR, Innovation models).

Moving forward there is a number of opportunities to extend the work presented in this paper. Firstly, the competency assessment tool presented here could provide a valuable input for the work by Feldmann (2011) to enable further validation of the 3 plant types within GONs (production; production and supply chain; production, supply chain and product/process development). Secondly, the application of the ‘Akondia’ framework for (re)designing or optimising a GON as a whole was not part of this research. Extending the application of the ‘Akondia’ framework from individual units (plants) within a GON to the system itself (GON) would provide interesting insights and contribute to the operations strategy literature by providing structured approaches for decision making. Finally, further validation of the ‘Akondia’ framework in other sectors is required to gain new insights into the mix of competencies that characterise each of Ferdows’ strategic plant roles and to further test the validity of the framework in other environments.

References