Stream 15. Technology, Innovation and Supply Chain Management
Refereed Delivered

Determinants for the organizational configuration of manufacturing companies offering data-based services

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Creating a service business as a manufacturing company is commonly known as servitization. While research provides a solid foundation in many sub-areas of servitization, it concentrates on traditional after-sales services. In the realm of organizational structuring, scholars mostly discuss whether to integrate or separate the service business. Focusing on data-based services, literature remains silent on their effects on the organizational structure. Thus, we enlighten this topic by collecting determinants from literature influencing the organizational design of a manufacturing company. Following a systematic approach, we qualitatively assessed the impact of 14 factors on their tendency to favor separation or integration. While a clear tendency cannot be stated, this work is a first step to clarify organizational configuration problems in this area.

Keywords: Service industries; Organisational performance; Operations management; E-business

Imagine a general manager of a manufacturing company searching for future growth and profit opportunities. A pure product orientation would most probably lead to the development of new and innovative products, or the penetration of additional markets with existing technology. Some managers might anticipate the potential of adding services to their product business, directing their company into a process commonly known as servitization (Baines, Lightfoot, Benedettini, & Kay, 2009; Vandermerwe & Rada, 1988).While the described situation is known for decades in academia, it is still a recurring phenomenon in practice. For instance, Hewitt (2002) describes a growing interest in the realm of servitization across scholars, practitioners and policymakers, while Baines et al. (2007), Baines et al. (2009), Lightfoot, Baines, and Smart (2013) and Baines et al. (2017) document the progress in this research field repeatedly and thoroughly.

When manufacturing companies decide to invest resources into the servitization of their organization, they are confronted with a series of barriers (Gebauer, Fleisch, & Friedli, 2005). To name a few, these include the change of the business model (Oliva & Kallenberg, 2003), articulating and pricing the benefits (Grubic, 2014), or transforming the organizational arrangement (Cyert & March, 1963; Goedkoop, van Halen, Te Riele, & Rommens, 1999). Focusing on the organizational configuration, two main perspectives exist (Gebauer, Pütz, Fischer, & Fleisch, 2009). On the one side, there is the market

rationale (Drucker, 1974) supporting the view and empirical evidence of Neu and Brown (2005) that products and services should be integrated when serving the same market (Oliva, Gebauer, & Brann, 2012). On the other side, several scholars (e.g. Gebauer et al., 2005; Oliva & Kallenberg, 2003) highlight the need for a separated service unit demonstrating the internal rationale (Bowen, Siehl, & Schneider, 1989; Oliva & Sterman, 2001).

Consequently, Baines et al. (2017) noticed that literature in the sphere of organizational configuration, structures and processes of servitized manufacturing companies still requires clarification. This argument is especially valid when considering new, advanced services relying upon connected devices and the exchange of data (cf. Grubic, 2014). These data-based services are likely to require a strong inter-firm collaboration during development and bear the potential to impact product development, in contrast to traditional after-sales services. Beside the insufficient knowledge about the organizational integration of data-based services at manufacturing companies, a thorough discussion of factors influencing the decision about the organizational design in this area is lacking (Baines et al., 2017).

Thus, we want to answer the question, *what determinants exist deciding upon the organizational configuration of manufacturing companies offering data-based services*.

To reach a scientifically sound basis, we build upon the organizational configuration theory of Mintzberg (1980) and adopt the literature search process of Webster and Watson (2002). In summary, the procedure revealed 54 articles assessed as particular relevant, in turn leading to a final list of 14 factors deemed to influence the organizational configuration of manufacturing companies offering or intending to offer data-based services. These determinants include inter alia the strategic orientation, market volatility, age and size of the company and the human resources.

The result demonstrates a high multi-variability and complexity of designing an organization, since the responsible manager has to keep all relevant factors and their interdependencies in mind. To handle this complexity, we now contribute with an enumeration of important aspects practitioners have to assess and scholars may use to investigate in-depth. Additionally, our paper contributes to the literature of organizational design by qualitatively discussing potential effects of each derived factor with the focus on service units in manufacturing companies.

The remainder of the article is structured as follows: First, we elaborate on the theoretical background of our research before presenting the applied method and results in Chapter 3. Afterwards, we discuss the findings and implications for theory and practice, as well as conclude with hints for future research.

2. THEORETICAL BACKGROUND

In the past, numerous scholars discussed the phenomenon of servitization in general terms and with different perspectives (e.g. Gebauer, Bravo-Sanchez, & Fleisch, 2007; Grubic, 2014; Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1988). Only few focused on implications on the structure and processes of the organization of manufacturing companies offering or intending to offer data-based services (e.g. Biege, Lay, & Buschak, 2012; Kowalkowski, Kindström, & Witell, 2011; Oliva et al., 2012). Yet, before going into details, we first delineate the theoretical background.

2.1 Theoretical Framing

Setting a theoretical layer underneath the own research feels somehow like choosing the hole through which we are looking at the problem on the other side of the wall.

While the contingency theory seemed appropriate on the first sight, (cf. Fiedler, 1964; Lawrence & Lorsch, 1967), we selected the organizational configuration theory proposed by Mintzberg (1980), discussing approaches on how to design organizations and suggesting five typologies of configurations. Mintzberg (1980) describes two hypotheses an organization should reflect. The congruence hypotheses explains that a purposeful configuration is tightly interlinked with contingency factors and so called "design parameters" (Mintzberg, 1980, p. 327), whereas the configuration hypotheses states that these parameters need to be consistent among each other. Based on his publication, Figure 1 sketches the interrelation between several crucial aspects of this theory and shows the interdependence of multiple factors influencing the realization of an effective organization with the structure at its heart.

Insert Figure 1 about here

We adopted this lens due to its distinct adherence to configuration problems and their underlying factors, closely reflecting our research problem. Additionally, Mintzberg (1980) identified several

factors, which we added to the final list. However, we first clarify the difference between certain service types, since, depending on the services a company may implement, the list of determinants affecting the organizational structure could possibly alter.

2.2 Service Types

Classification schemes

A typology of services that is often referred to was introduced by Mathieu (2001). She differs between two generic sorts of services: (1) services supporting the actual good sold and (2) services supporting the customer. The first case encompasses all traditional after-sales services, such as spare parts, repair and maintenance. Contrary, the latter case depicts elaborated services, exemplarily trainings or optimization services, for its execution deep process knowledge from the customer side is required (Mathieu, 2001).

Nonetheless, all named examples share the characteristic being independent from the product the company is actually selling. Independent in a sense that the services (repair instructions, training plans, etc.) are adapted and built upon a final product, but aspects of the service itself do not shape the product predominantly (Brown & Eisenhardt, 1995; Zirger & Maidique, 1990). Insights from some services may shape future product development. However, inter alia customer and performance requirements reflect the main influences for it (Ernst, 2002).

Traditional vs. data-based services

The servitization phenomenon describes the transformation of product-oriented manufacturing companies investing into and performing supporting services with the goal to generate higher profits by offering product-service bundles (Goedkoop et al., 1999; Tukker & Tischner, 2006; Vandermerwe & Rada, 1988). Most articles treating this topic only discuss services as the ones described above (e.g. cf. Gebauer, Friedli, & Fleisch, 2006; Kindström, 2010). Yet, we consider data-based, data-driven, or also known as smart services, going beyond the traditional services (Allmendinger & Lombreglia, 2005). In line with Allmendinger and Lombreglia (2005), we define data-based services as services requiring connected products at the customers' site, able to send, or even send and receive, data and making use of this data to generate benefits for the customer (cf. Bullinger, Meiren, & Nägele, 2015).

Compared to traditional services, data-based services are likely to require new or additional sensors and actors within the goods sold, bearing the potential to impact product development more than before (Allmendinger & Lombreglia, 2005; Bullinger et al., 2015). Hence, scholars agree that the implementation and development of (data-based) services within manufacturing companies leads to changes of the organizational structure (Gebauer et al., 2009; Turunen & Toivonen, 2011).

2.3 Separation or Integration

Introducing services within a formerly product-oriented company will require other capabilities and processes, thus lead to organizational change (Bustinza, Vendrell-Herrero, & Baines, 2017). As consent many scholars are about the fact that servitization, either with the premise to offer traditional or data-based services, necessitates a change of the organizational structure, as opposed they are in their view, which configuration an organization should adopt (Kowalkowski et al., 2011).

Transforming a configuration in this sense is commonly related to the creation of a service organization that may be integrated or separated, in turn, being in control of the service development, defining the revenue model, selling the service and providing it to the customer (Gebauer et al., 2009). While some authors assessed potential benefits of externalizing the service as a whole, the internal provision of services and the according research focus stays in a major role (Kowalkowski et al., 2011). Hence, scholars describe the internal provision of services largely with two extremes: one party highlights the positive effects of a separated service organization (e.g. Oliva et al., 2012), while the other party underpins the advantages of an integrated organization (Neu & Brown, 2005). Therefore, we briefly summarize key arguments of each side in the subsequent paragraphs.

Main representatives advocating the separation of the service from the product business by calling it vital to successfully drive the service business are Oliva and Kallenberg (2003). After them, companies are usually entering new markets when enforcing a service strategy favoring a separated department to handle the uncertainties autonomously and to address the specific requirements (Drucker, 1974). Enlarging the service portfolio is as well connected with a transition to a separated service organization, since the personnel is expected to orient themselves better towards a service philosophy (Turunen & Toivonen, 2011), leading to an increased concentration on and preservation of a service culture

(Bowen et al., 1989). According to the theory that an optimal information flow is different for an organization developing products (centralized information is favored) and for one innovating services (decentralized information is preferred), Kim, Park, and Prescott (2003) propose that these two conflicting positions should be pursued in different business units.

These arguments result in the perspective that a separated service unit achieves higher organizational distinction, going hand in hand with management attention when being executed as a profit center and higher visibility towards the customers (Oliva et al., 2012).

Yet, a distinct separation between service and product business was also found to have a negative effect on the overall motivation to execute the service strategy (Gebauer et al., 2009). Besides effects on the thinking and orientation of the employees, the underlying logic of the group of scholars defending the view of an integrated solution is reflected by the market rationale (Drucker, 1974). Assuming that the focal firm is serving certain markets with their connected products, the firm is likely to develop data-based services for the same customers possessing the appropriate hardware on-site, hence, serving the same market. This means in line with Neu and Brown (2008) and Drucker (1974) that a company should cluster their products and services with respect to the markets they are delivering to. Consequently, when products and services serve the same customers, the company should pursue a mutual development in order to increase synergies and to address a broader customer need (Biege et al., 2012).

While the point of views we presented afore depict extreme positions, it is apparent that these perspectives increasingly blur. For instance, Turunen and Toivonen (2011) explain that despite the former emphasis on a separate service organization, the separation per se does not ensure success. A successful commercialization of services is rather achieved with a consistent service orientation, feasible in both configurations (Gebauer et al., 2009) by concentrating on the right organizational structure for the appropriate service strategy (Auguste, Harmon, & Pandit, 2006; Gebauer, Fischer, & Fleisch, 2010).

That said, what should be pursued? According to Hax and Majluf (1983), as well as Mintzberg (1980), the final structure is highly individual and should be designed upon the relevant contingency factors. Some of these factors may be obvious; nevertheless, a comprehensive and systematic collection of

factors influencing the organizational configuration of a manufacturing company introducing data-based services has not been done before and is thus executed in the following.

3. FINDINGS

So far, in practice one cannot recognize a dominant strategy on how companies design their organization to serve their customers a portfolio of products and services as good as possible. This gave us the impetus to investigate determinants affecting an optimal structure depending on the unique contingencies of manufacturing companies offering or intending to offer data-based services.

3.1 Method

14 factors, summarized and clustered in Table 1, were collected from literature following the literature search process of Webster and Watson (2002). Conducting a literature review in a systematic manner increases the credibility on the found articles (Denyer & Tranfield, 2009; Tranfield, Denyer, & Smart, 2003) and therefore enhances the validity onto the derived concepts and conclusion of the research (Baker, 2000; Vom Brocke et al., 2009). We thus proceeded by delineating important keywords and search algorithms (e.g. “data-based service” AND organization), while listing the results thoroughly (cf. Webster & Watson, 2002). According to Webster and Watson (2002), we continued with screening the cited references and those articles citing the found artefact. This procedure led to a final amount of 54 publications treating data-based services in the realm of manufacturing companies and organizational structuring. Although searching for relevant literature in a systematic and meticulous way, it may arrive that some articles were not discovered. Nevertheless, we observed theoretical saturation (Corbin & Strauss, 2009) after analyzing the derived sample of artefacts.

3.2 Influencing Factors

Before presenting the factors illustrated in Table 1, we have to state that we explicitly strove to collect the elements in an unbiased manner. Meaning, we are not judging and assessing the significance of each factor related to its impact onto the organizational structure in the first place. The upcoming enumeration is therefore not sorted with a particular logic.

Insert Table 1 about here

Market related characteristics

The first group of factors encompass elements linked to the presence in, properties and diversity of markets a company is handling. As such, fluctuating markets require vast flexibility and dynamic capabilities within organizations enabling them to tackle the altering environmental conditions (Teece, Pisano, & Shuen, 1997). Accordingly, the organizational structure is assessed as being influenced by market volatility (Kowalkowski et al., 2011; Neu & Brown, 2005). Neu and Brown (2005) argue that integrating the service unit favors a concentration on specific markets with certain bundles of services and products. Thus, it may be superior to organize by devotion to market segments to consolidate market knowledge and build upon these particular experiences. Mintzberg (1980) is taking the same line by articulating that an organizations' design should mirror the diversified markets they are operating in. Assuming, a company is serving one or more of its market segments with a portfolio of physical products and data-based services, the maturity of the data-based service business will likely influence the structure as well (Gebauer, Saul, Haldimann, & Gustafsson, 2016). Starting to provide data-based services might be realized by occasionally devoted (e.g. sales staff) and a handful of focused employees (e.g. service innovation), who may work within their current departments. Yet, when the company increases their investment into this field, rising sales and profit numbers to a significant amount, Oliva and Kallenberg (2003), as well as Biege et al. (2012) conclude that a transition to a separated business unit should be pursued.

Offer related characteristics

The second cluster of determinants shows the dependence of the organizational structure on the products and services a company is offering. For instance, depending on the product itself, there may be a shift between resources needed to develop and produce a certain good, whether it is fairly simple or highly complex. Thus, characteristics of the product for which data-based services are designed are likely to affect potential services and the organizational structure as well (Oliva et al., 2012).

The interdependence of physical products and services is dichotomous. As mentioned in Chapter 2.3, most articles treat product-service bundles with no or very few interfaces during the development. Hence, the interdependence is rather low. However, with the rising importance of data-based services new value propositions (complex comprehensive offers) are much more intertwined leading to development cycles, where product and service development teams need to work with each other (Kindström, Kowalkowski, & Alejandro, 2015; Kotler & Keller, 2016). The relation of products and data-based services may thus be described by *the separability of the value proposition*. The term we introduce defines to what extent a product or (data-based) service is able to be sold on its own, or is only able to deliver the desired value when bundled. Transferring this view into the design of an organization, stand-alone products and services are possible to be developed separately from each other, while closely intertwined and complex value propositions create stronger coherence in an integrated form.

Whether a company is selling services as an add-on to products (Oliva et al., 2012) or strive to leverage a higher profit share (Turunen & Toivonen, 2011) will be mainly directed by the strategy (Galbraith, 2002; Gebauer et al., 2010). Already discovered by Chandler (1962) and Mintzberg (1980), strategy is likely to have a significant impact on a firms' structure. Imagine a company pursuing their service business mainly as a marketing tool to promote their competitive products, compared to companies striving to diminish the effect of their commoditized product, thus seeking services as a major income stream. Nevertheless, a clear tendency on which effect the strategy has on the structure does not exist. While separation defenders, such as Oliva and Kallenberg (2003), advocate separation with increasing service focus, we believe it is exactly the other way round. With a strong devotion to data-based services, the product has likely to be modified and adapted. Consequently, adjusting the attention to data-based services requires strong intra-firm collaboration leading to integrated team structures (cf. Neu & Brown, 2005, 2008). Hence, strategy is a multifaceted factor not unequivocally assignable to one or another group of determinants.

Intangible organizational characteristics

Factors being categorized into the third group share aspects developed naturally over time, or are historically practiced in a certain manner. Age and size of a company are two examples that evolved over time and still influences the design of an organization (Mintzberg, 1980). Older companies are often seen similar to rigid and bureaucratic organizations unfolding higher barriers than young and flexible start-ups (Mintzberg, 1991). Thus, introducing services in an established (old) company favors separation, since the changes needed to realize an integrated solution bear friction and high cost.

Another aspect often treated is the culture of such organizations. While we do not want to spread the gates for a philosophical conversation about culture in general, we have to admit that product development and sales staff think and value differently. For instance, the degree to which these employees set the needs and problems of their customers in the center of their work varies a lot (Gebauer et al., 2009; Kindström et al., 2015; Matthyssens & Vandenbempt, 1998; Turunen & Toivonen, 2011). Termed customer centricity (Gebauer et al., 2009), the organization is likely to differ concerning its processes and structures, whether its DNA is mainly induced by a technology push or a market pull philosophy. It may be obvious that designing new services requires extensive customer knowledge, especially when these enfold their highest value once being co-created with the customer (cf. Vargo, Maglio, & Akaka, 2008). Separation would ease the incorporation of customers, their knowledge and the transfer within a smaller part of the company, while integration has the potential to change the mindset of all employees.

When increasing the focus on distributed service personnel establishing bonds with customers and transporting the field knowledge back to the company, another effect goes hand in hand: the power structure (Mintzberg, 1980). In traditional product and technology driven organizations the decision-making authority is usually centralized, whereas service organizations favor decentralization (Homburg, Workman, & Jensen, 2000; Neu & Brown, 2005, 2008), similar to information flows.

Tangible structural characteristics

The decentralization of decision-making authority is as well captured in an additional factor coined by Neu and Brown (2005, 2008) and part of the last group of elements. They believe an organization should build up integrated business unit responsibilities for products and the corresponding

services. This covers as well the service development process, the sales process, strategy and channel, described as determinants for the organizational structure by Burton, Story, Raddats, and Zolkiewski (2017) and by Gebauer et al. (2009), Kindström et al. (2015), Kowalkowski et al. (2011) respectively. A distinct service sales department, including the according processes, strategies and channels, clearly prefers separation (Gebauer et al., 2009; Kindström et al., 2015; Kowalkowski et al., 2011). Contrary, it is difficult to state, whether the service development process should be pursued in a separated or integrated form (Burton et al., 2017), referring to the separability of the value proposition.

Further, the technical system, defined by the way of working, is linked to the degree of formalization (Mintzberg, 1980). Thus, highly controlled processes will be rather found in bureaucratic organizations tending to be old in age and large in size, while a higher flexibility is often found in younger companies (Mintzberg, 1980). Considering this, the technical system influences the organizational design, whereas a significant causality between the degree of formalization and the degree of separation cannot be stated.

Slightly apart from other factors within this group, the last element concerns people working at the focal organization. Since most companies face limited financial and human resources (Kowalkowski et al., 2011), thinking about a feasible organizational structure depends upon the personnel (Galbraith, 2002; Neu & Brown, 2005, 2008). Meaning, if an organization engages employees being talents in more than one field, it may be possible and viable to integrate the service and product organization. Yet, if the human resources reflect a strong focus on technology and the continuous development of new products, a separated organization with new inputs may promise better performance.

The brief discussion of each factor shows no clear tendency, whether a typical manufacturing company offering or intending to offer data-based services should integrate or separate the service organization. Thus, the upcoming chapter summarizes the findings and sets them into context, before presenting its implications on theory, practice and future research.

4. CONLUSION

With the impetus to provide a comprehensive overview on factors determining the organizational structure of manufacturing companies on their path to offer data-based services, we dived deep into

literature by following a systematic approach. We captured 14 partly stand-alone, partly interdependent variables, ranging from obvious factors (e.g. service strategy) to ambiguous elements (e.g. degree of customer centricity). Presenting them in an unbiased manner was vital to enhance objectivity and reduce predisposition. The qualitative discussion of each factor revealed no clear tendency, whether a manufacturing company should integrate or separate the data-based service business. Yet, it is likely that not all organizations are influenced by each factor equally. Therefore, a manager has to evaluate carefully, which factor impacts his organization and what the appropriate reaction is going to be.

With the list at hand, managers have now higher transparency onto determinants that might affect the performance of the service business negatively, when the organizational form is not adapted to the new circumstances. While practical relevance is important in our research and mirrors a distinct contribution of this paper, we intertwined the practical gap with propositions of Baines et al. (2017) to clarify the discussion about the organizational structure of manufacturing companies offering data-based services. The contribution of our research is thus twofold. First, we summarize important factors influencing the organizational structure and second, we discuss each factor on its tendency to favor separation or integration. Based on the organizational configuration theory of Mintzberg (1980), we elucidate specific parameters, enriching the initial set of factors and strengthening the validity of his theory.

Yet, presenting and discussing these factors qualitatively is only one-step forward. In the future, our research is led by validating the significance of these factors in real-world case studies with manufacturing companies being in the process of transforming their organization. Once these factors are backed by additional data, further research may also investigate in more depth the impact of each parameter on specific operating models and processes within the focal firms.

To conclude, our research was directed by the distinct effort to enlighten the conversation about organizational configuration problems in manufacturing companies. While the nature of this problem is highly practical, we anticipated the possibility to offer a mean for practitioners and scholars, which can be used in both worlds. Collecting and setting the factors into context was therefore the logical first step to reach clarification within this topic.

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Figure 1: Organizational configuration theory. Own illustration based on Mintzberg (1980)

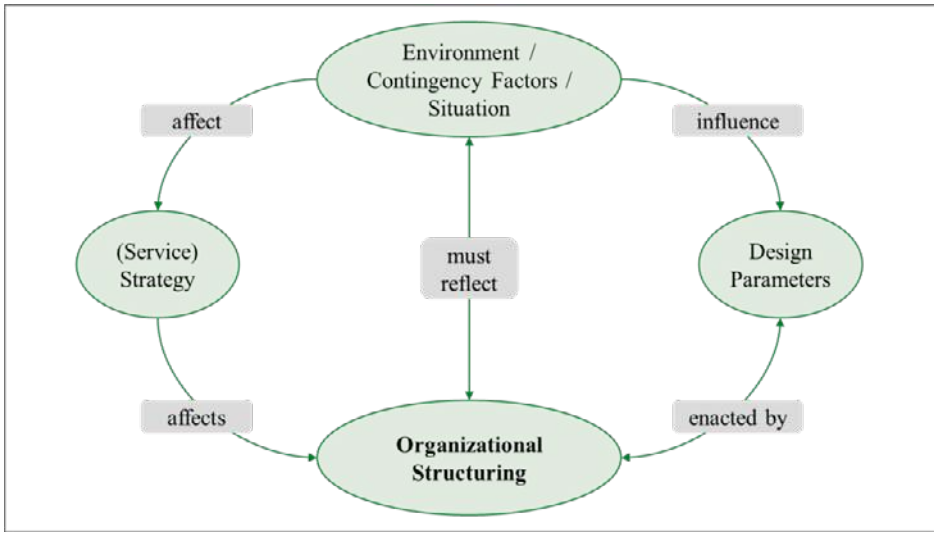


Table 1: Summary of influencing factors. Own illustration.

Factor	Category	Reference
Maturity of data-based service business	Market related characteristics	Gebauer et al., 2016
Diversification of the organization's markets		Mintzberg, 1980
Market volatility		cf. Kowalkowski et al., 2011; Neu & Brown, 2005
Separability of the value proposition	Offer related characteristics	cf. Kindström et al., 2015; Kotler & Keller, 2016; Kowalkowski et al., 2011
Service strategy		Chandler, 1962; Galbraith, 2002; Kowalkowski et al., 2011; Mintzberg, 1980
Product characteristics		cf. Oliva et al., 2012
Degree of centralization of decision-making authority (power structure)	"Intangible" organizational characteristics	Homburg et al., 2000; Mintzberg, 1980; Neu & Brown, 2005, 2008
Age and size		Mintzberg, 1980
Degree of customer centricity		Gebauer et al., 2009; Kindström et al., 2015; Matthyssens & Vandenbempt, 1998; Turunen & Toivonen, 2011
Human resources	"Tangible" structural characteristics	Galbraith, 2002; Kowalkowski et al., 2011; Neu & Brown, 2005, 2008
Integrated business unit responsibilities		Neu & Brown, 2005, 2008
Service development process		Burton et al., 2017
Technical system		Mintzberg, 1980
Sales process – strategy and channel		Gebauer et al., 2009; Kindström et al., 2015; Kowalkowski et al., 2011