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When to use and how to report the results of PLS-SEM

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Abstract

Purpose – The purpose of this paper is to provide a comprehensive, yet concise, overview of the considerations and metrics required for partial least squares structural equation modeling (PLS-SEM) analysis and result reporting. Preliminary considerations are summarized first, including reasons for choosing PLS-SEM, recommended sample size in selected contexts, distributional assumptions, use of secondary data, statistical power and the need for goodness-of-fit testing. Next, the metrics as well as the rules of thumb that should be applied to assess the PLS-SEM results are covered. Besides presenting established PLS-SEM evaluation criteria, the overview includes the following new guidelines: PLSpredict (i.e., a novel approach for assessing a model’s out-of-sample prediction), metrics for model comparisons, and several complementary methods for checking the results’ robustness.

Design/methodology/approach – This paper provides an overview of previously and recently proposed metrics as well as rules of thumb for evaluating the research results based on the application of PLS-SEM.

Findings – Most of the previously applied metrics for evaluating PLS-SEM results are still relevant. Nevertheless, scholars need to be knowledgeable about recently proposed metrics (e.g. model comparison criteria) and methods (e.g. endogeneity assessment, latent class analysis and PLSpredict), and when and how to apply them to extend their analyses.

Research limitations/implications – Methodological developments associated with PLS-SEM are rapidly emerging. The metrics reported in this paper are useful for current applications, but must always be up to date with the latest developments in the PLS-SEM method.

Originality/value – In light of more recent research and methodological developments in the PLS-SEM domain, guidelines for the method’s use need to be continuously extended and updated. This paper is the

Even though this article does not use the statistical software SmartPLS (www.smartpls.com), Ringle acknowledges a financial interest in SmartPLS.
most current and comprehensive summary of the PLS-SEM method and the metrics applied to assess its solutions.

**Keywords**  Structural equation modeling, Partial least squares, PLS-SEM, Model comparisons, PLSpredict

**Paper type** General review

**Introduction**
For many years, covariance-based structural equation modeling (CB-SEM) was the dominant method for analyzing complex interrelationships between observed and latent variables. In fact, until around 2010, there were far more articles published in social science journals that used CB-SEM instead of partial least squares structural equation modeling (PLS-SEM). In recent years, the number of published articles using PLS-SEM increased significantly relative to CB-SEM (Hair et al., 2017b). In fact, PLS-SEM is now widely applied in many social science disciplines, including organizational management (Sosik et al., 2009), international management (Richter et al., 2015), human resource management (Ringle et al., 2019), management information systems (Ringle et al., 2012), operations management (Peng and Lai, 2012), marketing management (Hair et al., 2012b), management accounting (Nitzl, 2016), strategic management (Hair et al., 2012a), hospitality management (Ali et al., 2018b) and supply chain management (Kaufmann and Gaeckler, 2015). Several textbooks (e.g., Garson, 2016; Ramayah et al., 2016), edited volumes (e.g., Avkiran and Ringle, 2018; Ali et al., 2018a), and special issues of scholarly journals (e.g., Rasoolimanesh and Ali, 2018; Shiau et al., 2019) illustrate PLS-SEM or propose methodological extensions.

The PLS-SEM method is very appealing to many researchers as it enables them to estimate complex models with many constructs, indicator variables and structural paths without imposing distributional assumptions on the data. More importantly, however, PLS-SEM is a causal-predictive approach to SEM that emphasizes prediction in estimating statistical models, whose structures are designed to provide causal explanations (Wold, 1982; Sarstedt et al., 2017a). The technique thereby overcomes the apparent dichotomy between explanation – as typically emphasized in academic research – and prediction, which is the basis for developing managerial implications (Hair et al., 2019). Additionally, user-friendly software packages are available that generally require little technical knowledge about the method, such as PLS-Graph (Chin, 2003) and SmartPLS (Ringle et al., 2015; Ringle et al., 2005), while more complex packages for statistical computing software environments, such as R, can also execute PLS-SEM (e.g. semPLS; Monecke and Leisch, 2012). Authors such as Richter et al. (2016), Rigdon (2016) and Sarstedt et al. (2017a) provide more detailed arguments and discussions on when to use and not to use PLS-SEM.

The objective of this paper is to explain the procedures and metrics that are applied by editors and journal review boards to assess the reporting quality of PLS-SEM findings. We first summarize several initial considerations when choosing to use PLS-SEM and cover aspects such as sample sizes, distributional assumptions and goodness-of-fit testing. Then, we discuss model evaluation, including rules of thumb and introduce important advanced options that can be used. Our discussion also covers PLSpredict, a new method for assessing a model’s out-of-sample predictive power (Shmueli et al., 2016; Shmueli et al., 2019), which researchers should routinely apply, especially when drawing conclusions that affect business practices and have managerial implications. Next, we introduce several complementary methods for assessing the results’ robustness when it comes to measurement model specification, nonlinear structural model effects, endogeneity and unobserved heterogeneity (Hair et al., 2018; Latan, 2018). Figure 1 illustrates the various aspects that we discuss in the following sections.
Preliminary considerations

The Swedish econometrician Herman O. A. Wold (1975, 1982, 1985) developed the statistical underpinnings of PLS-SEM. The method was initially known and is sometimes still referred to as PLS path modeling (Hair et al., 2011). PLS-SEM estimates partial model structures by combining principal components analysis with ordinary least squares regressions (Mateos-Aparicio, 2011). This method is typically viewed as an alternative to Jöreskog’s (1973) CB-SEM, which has numerous—typically very restrictive—assumptions (Hair et al., 2011).

Jöreskog’s (1973) CB-SEM, which is often executed by software packages such as LISREL or AMOS, uses the covariance matrix of the data and estimates the model parameters by only considering common variance. In contrast, PLS-SEM is referred to as variance-based, as it accounts for the total variance and uses the total variance to estimate parameters (Hair et al., 2017b).

In the past decade, there has been a considerable debate about which situations are more or less appropriate for using PLS-SEM (Goodhue et al., 2012; Marcoulides et al., 2012; Marcoulides and Saunders, 2006; Rigdon, 2014a; Henseler et al., 2014; Khan et al., 2019). In the following sections, we summarize several initial considerations when to use PLS-SEM (Hair et al., 2013). Furthermore, we compare the differences between CB-SEM and PLS-SEM (Marcoulides and Chin, 2013; Rigdon, 2016). In doing so, we note that recent research has moved beyond the CB-SEM versus PLS-SEM debate (Rigdon et al., 2017; Rigdon, 2012), by
establishing PLS-SEM as a distinct method for analyzing composite-based path models. Nevertheless, applied research is still confronted with the choice between the two SEM methods. Researchers should select PLS-SEM:

- when the analysis is concerned with testing a theoretical framework from a prediction perspective;
- when the structural model is complex and includes many constructs, indicators and/or model relationships;
- when the research objective is to better understand increasing complexity by exploring theoretical extensions of established theories (exploratory research for theory development);
- when the path model includes one or more formatively measured constructs;
- when the research consists of financial ratios or similar types of data artifacts;
- when the research is based on secondary/archival data, which may lack a comprehensive substantiation on the grounds of measurement theory;
- when a small population restricts the sample size (e.g. business-to-business research); but PLS-SEM also works very well with large sample sizes;
- when distribution issues are a concern, such as lack of normality; and
- when research requires latent variable scores for follow-up analyses.

The above list provides an overview of points to consider when deciding whether PLS is an appropriate SEM method for a study.

Sample size

PLS-SEM offers solutions with small sample sizes when models comprise many constructs and a large number of items (Fornell and Bookstein, 1982; Willaby et al., 2015; Hair et al., 2017b). Technically, the PLS-SEM algorithm makes this possible by computing measurement and structural model relationships separately instead of simultaneously. In short, as its name implies, the algorithm computes partial regression relationships in the measurement and structural models by using separate ordinary least squares regressions. Reinartz et al. (2009), Henseler et al. (2014) and Sarstedt et al. (2016b) summarize how PLS-SEM provides solutions when methods such as CB-SEM develop inadmissible results or do not converge with complex models and small sample sizes, regardless of whether the data originates from a common or composite model population. Hair et al. (2013) indicate that certain scholars have falsely and misleadingly taken advantage of these characteristics to generate solutions with extremely small sample sizes, even when the population is large and accessible without much effort. This practice has unfortunately damaged the reputation of PLS-SEM to some extent (Marcoulides et al., 2009). Like other multivariate methods, PLS-SEM is not capable of turning a poor (e.g. non-representative) sample into a proper one to obtain valid model estimations.

PLS-SEM can certainly be used with smaller samples but the population’s nature determines the situations in which small sample sizes are acceptable (Rigdon, 2016). Assuming that other situational characteristics are equal, the more heterogeneous the population, the larger the sample size needed to achieve an acceptable sampling error (Cochran, 1977). If basic sampling theory guidelines are not considered (Sarstedt et al., 2018), questionable results are produced. To determine the required sample size, researchers should rely on power analyses that consider the model structure, the anticipated significance level and the expected effect sizes (Marcoulides and Chin, 2013). Alternatively, Hair et al. (2017a) have documented power tables indicating the required sample sizes for a variety of
measurement and structural model characteristics. Finally, Kock and Hadaya (2018) suggest the inverse square root method and the gamma-exponential method as two new approaches for minimum sample size calculations.

Akter et al. (2017) note that most prior research on sample size requirements in PLS-SEM overlooked the fact that the method also proves valuable for analyzing large data quantities. In fact, PLS-SEM offers substantial potential for analyzing large data sets, including secondary data, which often does not include comprehensive substantiation on the grounds of measurement theory (Rigdon, 2013).

**Distributional assumptions**

Many scholars indicate that the absence of distributional assumptions is the main reason for choosing PLS-SEM (Hair et al., 2012b; Nitzl, 2016; do Valle and Assaker, 2016). While this is clearly an advantage of using PLS-SEM in social science studies, which almost always rely on nonnormal data, on its own, it is not a sufficient justification.

Scholars have noted that maximum likelihood estimation with CB-SEM is robust against violations of normality (Chou et al., 1991; Olsson et al., 2000), although it may require much larger sample sizes (Boomsma and Hoogland, 2001). If the size of the data set is limited, CB-SEM can produce abnormal results when data are nonnormal (Reinartz et al., 2009), while PLS-SEM shows a higher robustness in these situations (Sarstedt et al., 2016b).

It is noteworthy that in a limited number of situations, nonnormal data can also affect PLS-SEM results (Sarstedt et al., 2017a). For instance, bootstrapping with nonnormal data can produce peaked and skewed distributions. The use of the bias-corrected and accelerated (BCa) bootstrapping routine handles this issue to some extent, as it adjusts the confidence intervals for skewness (Efron, 1987). Only choosing PLS-SEM for data distribution reasons is, therefore, in most instances not sufficient, but it is definitely an advantage in combination with other reasons for using PLS-SEM.

**Secondary data**

Secondary (or archival) data are increasingly available to explore real-world phenomena (Avkiran and Ringle, 2018). Research which is based on secondary data typically focuses on a different objective than in a standard CB-SEM analysis, which is strictly confirmatory in nature. More precisely, secondary data are mainly used in exploratory research to propose causal relationships in situations which have little clearly defined theory (Hair et al., 2017a, 2017b). Such settings require researchers to put greater emphasis on examining all possible relationships rather than achieving model fit (Nitzl, 2016). By its nature, this process creates large complex models that cannot be analyzed with the full information CB-SEM method. In contrast, the iterative approach of PLS-SEM uses limited information, making the method more robust and not constrained by the requirements of CB-SEM (Hair et al., 2014). Thus, PLS-SEM is very suitable for exploratory research with secondary data, because it offers the flexibility needed for the interplay between theory and data (Nitzl, 2016) or, as Wold (1982 p. 29) notes, “soft modeling is primarily designed for research contexts that are simultaneously data-rich and theory-skeletal.” Furthermore, the increasing popularity of secondary data analysis (e.g. by using data that stem from company databases, social media, customer tracking, national statistical bureaus or publicly available survey data) shifts the research focus from strictly confirmatory to predictive and causal-predictive modeling. Such research settings are a perfect fit for the prediction-oriented PLS-SEM approach.

PLS-SEM also proves valuable for analyzing secondary data from a measurement theory perspective. Unlike survey measures, which are usually crafted to confirm a well-developed
theory, measures used in secondary data sources are typically not created and refined over
time for confirmatory analyses (Sarstedt and Mooi, 2019). Thus, achieving model fit with
secondary data measures is unlikely in most research situations when using CB-SEM.
Furthermore, researchers who use secondary data do not have the opportunity to revise or
refine the measurement model to achieve fit. Another major advantage of PLS-SEM in this
context is that it permits the unrestricted use of single-item and formative measures (Hair
et al., 2014). This is extremely valuable for archival research, because many measures are
actually artifacts found in corporate databases, such as financial ratios and other firm-fixed
factors (Richter et al., 2016). Often, several types of financial data may be used to create an
index as a measure of performance (Sarstedt et al., 2017a, 2017b). For instance, Ittner et al.
(1997) operationalized strategy with four indicators as follows: the ratio of research and
development to sales, the market-to-book ratio, the ratio of employees to sales and the
number of new product or service introductions. Similarly, secondary data could be used to
form an index of a company’s communication activities, covering aspects such as online
advertising, sponsoring or product placement (Sarstedt and Mooi, 2019). PLS-SEM should
always be the preferred approach in situations with formatively measured constructs,
because a MIMIC approach in CB-SEM imposes constraints on the model that often
contradict the theoretical assumptions (Sarstedt et al., 2016b).

Statistical power
When using PLS-SEM, researchers benefit from the method’s high degree of statistical
power compared to CB-SEM (Reinartz et al., 2009; Hair et al., 2017b). This characteristic
holds even when estimating common factor model data as assumed by CB-SEM (Sarstedt
et al., 2016b). Greater statistical power means that PLS-SEM is more likely to identify
relationships as significant when they are indeed present in the population (Sarstedt and
Mooi, 2019).

The PLS-SEM characteristic of higher statistical power is quite useful for exploratory
research that examines less developed or still developing theory. Wold (1985, p. 590)
describes the use of PLS-SEM as “a dialogue between the investigator and the computer.
Tentative improvements of the model—such as the introduction of a new latent variable, an
indicator, or an inner relation, or the omission of such an element—are tested for predictive
relevance [. . . ] and the various pilot studies are a speedy and low-cost matter.” Of particular
importance, however, is that PLS-SEM is not only appropriate for exploratory research but
also for confirmatory research (Hair et al., 2017a).

Goodness-of-fit
While CB-SEM strongly relies on the concept of model fit, this is much less the case with
PLS-SEM (Hair et al., 2019). Consequently, some researchers incorrectly conclude that PLS-
SEM is not useful for theory testing and confirmation (Westland, 2015). A couple of
methodologists have endorsed model fit measures for PLS-SEM (Henseler et al., 2016a), but
researchers should be very cautious when considering the applicability of these measures
for PLS-SEM (Henseler and Sarstedt, 2013; Hair et al., 2019). First, a comprehensive
assessment of these measures has not been conducted so far. Therefore, any thresholds
(guidelines) advocated in the literature should be considered as very tentative. Second, as the
algorithm for obtaining PLS-SEM solutions is not based on minimizing the divergence
between observed and estimated covariance matrices, the concept of Chi-square-based
model fit measures and their extentions – as used in CB-SEM – are not applicable. Hence,
even bootstrap-based model fit assessments on the grounds of, for example, some distance
measure or the SRMR (Henseler et al., 2016a; Henseler et al., 2017), which quantify the
divergence between the observed and estimated covariance matrices, should be considered with extreme caution. Third, scholars have questioned whether the concept of model fit, as applied in the context of CB-SEM research, is of value to PLS-SEM applications in general (Hair et al., 2017a; Rigdon, 2012; Lohmöller, 1989).

PLS-SEM primarily focuses on the interplay between prediction and theory testing and results should be validated accordingly (Shmueli, 2010). In this context, scholars have recently proposed new evaluation procedures that are designed specifically for PLS-SEM’s prediction-oriented nature (Shmueli et al., 2016).

**Evaluation of partial least squares-structural equation modeling results**

The first step in evaluating PLS-SEM results involves examining the measurement models. The relevant criteria differ for reflective and formative constructs. If the measurement models meet all the required criteria, researchers then need to assess the structural model (Hair et al., 2017a). As with most statistical methods, PLS-SEM has rules of thumb that serve as guidelines to evaluate model results (Chin, 2010; Götz et al., 2010; Henseler et al., 2009; Chin, 1998; Tenenhaus et al., 2005; Roldán and Sánchez-Franco, 2012; Hair et al., 2017a). Rules of thumb – by their very nature – are broad guidelines that suggest how to interpret the results, and they typically vary depending on the context. As an example, reliability for exploratory research should be a minimum of 0.60, while reliability for research that depends on established measures should be 0.70 or higher. The final step in interpreting PLS-SEM results, therefore, involves running one or more robustness checks to support the stability of results. The relevance of these robustness checks depends on the research context, such as the aim of the analysis and the availability of data.

**Assessing reflective measurement models**

The first step in reflective measurement model assessment involves examining the indicator loadings. Loadings above 0.708 are recommended, as they indicate that the construct explains more than 50 per cent of the indicator’s variance, thus providing acceptable item reliability.

The second step is assessing internal consistency reliability, most often using Jöreskog’s (1971) composite reliability. Higher values generally indicate higher levels of reliability. For example, reliability values between 0.60 and 0.70 are considered “acceptable in exploratory research,” values between 0.70 and 0.90 range from “satisfactory to good.” Values of 0.95 and higher are problematic, as they indicate that the items are redundant, thereby reducing construct validity (Diamantopoulos et al., 2012; Drolet and Morrison, 2001). Reliability values of 0.95 and above also suggest the possibility of undesirable response patterns (e.g. straight lining), thereby triggering inflated correlations among the indicators’ error terms. Cronbach’s alpha is another measure of internal consistency reliability that assumes similar thresholds, but produces lower values than composite reliability. Specifically, Cronbach’s alpha is a less precise measure of reliability, as the items are unweighted. In contrast, with composite reliability, the items are weighted based on the construct indicators’ individual loadings and, hence, this reliability is higher than Cronbach’s alpha. While Cronbach’s alpha may be too conservative, the composite reliability may be too liberal, and the construct’s true reliability is typically viewed as within these two extreme values. As an alternative, Dijkstra and Henseler (2015) proposed $\rho_A$ as an approximately exact measure of construct reliability, which usually lies between Cronbach’s alpha and the composite reliability. Hence, $\rho_A$ may represent a good compromise if one assumes that the factor model is correct.
In addition, researchers can use bootstrap confidence intervals to test if the construct reliability is significantly higher than the recommended minimum threshold (e.g. the lower bound of the 95 per cent confidence interval of the construct reliability is higher than 0.70). Similarly, they can test if construct reliability is significantly lower than the recommended maximum threshold (e.g. the upper bound of the 95 per cent confidence interval of the construct reliability is lower than 0.95). To obtain the bootstrap confidence intervals, in line with Aguirre-Urreta and Rönkkö (2018), researchers should generally use the percentile method. However, when the reliability coefficient’s bootstrap distribution is skewed, the BCa method should be preferred to obtain bootstrap confidence intervals.

The third step of the reflective measurement model assessment addresses the convergent validity of each construct measure. Convergent validity is the extent to which the construct converges to explain the variance of its items. The metric used for evaluating a construct’s convergent validity is the average variance extracted (AVE) for all items on each construct. To calculate the AVE, one has to square the loading of each indicator on a construct and compute the mean value. An acceptable AVE is 0.50 or higher indicating that the construct explains at least 50 per cent of the variance of its items.

The fourth step is to assess discriminant validity, which is the extent to which a construct is empirically distinct from other constructs in the structural model. Fornell and Larcker (1981) proposed the traditional metric and suggested that each construct’s AVE should be compared to the squared inter-construct correlation (as a measure of shared variance) of that same construct and all other reflectively measured constructs in the structural model. The shared variance for all model constructs should not be larger than their AVEs. Recent research indicates, however, that this metric is not suitable for discriminant validity assessment. For example, Henseler et al. (2015) show that the Fornell-Larcker criterion does not perform well, particularly when the indicator loadings on a construct differ only slightly (e.g. all the indicator loadings are between 0.65 and 0.85).

As a replacement, Henseler et al. (2015) proposed the heterotrait-monotrait (HTMT) ratio of the correlations (Voorhees et al., 2016). The HTMT is defined as the mean value of the item correlations across constructs relative to the (geometric) mean of the average correlations for the items measuring the same construct. Discriminant validity problems are present when HTMT values are high. Henseler et al. (2015) propose a threshold value of 0.90 for structural models with constructs that are conceptually very similar, for instance cognitive satisfaction, affective satisfaction and loyalty. In such a setting, an HTMT value above 0.90 would suggest that discriminant validity is not present. But when constructs are conceptually more distinct, a lower, more conservative, threshold value is suggested, such as 0.85 (Henseler et al., 2015). In addition to these guidelines, bootstrapping can be applied to test whether the HTMT value is significantly different from 1.00 (Henseler et al., 2015) or a lower threshold value such as 0.85 or 0.90, which should be defined based on the study context (Franke and Sarstedt, 2019). More specifically, the researcher can examine if the upper bound of the 95 per cent confidence interval of HTMT is lower than 0.90 or 0.85.

Assessing formative measurement models

PLS-SEM is the preferred approach when formative constructs are included in the structural model (Hair et al., 2019). Formative measurement models are evaluated based on the following: convergent validity, indicator collinearity, statistical significance, and relevance of the indicator weights (Hair et al., 2017a).

For formatively measured constructs, convergent validity is assessed by the correlation of the construct with an alternative measure of the same concept. Originally proposed by Chin (1998), the procedure is referred to as redundancy analysis. To
execute this procedure for determining convergent validity, researchers must plan already in the research design stage to include alternative reflectively measured indicators of the same concept in their questionnaire. Cheah et al. (2018) show that a single-item, which captures the essence of the construct under consideration, is generally sufficient as an alternative measure – despite limitations with regard to criterion validity (Sarstedt et al., 2016a). When the model is based on secondary data, a variable measuring a similar concept would be used (Houston, 2004). Hair et al. (2017a) suggest that the correlation of the formatively measured construct with the single-item construct, measuring the same concept, should be 0.70 or higher.

The variance inflation factor (VIF) is often used to evaluate collinearity of the formative indicators. VIF values of 5 or above indicate critical collinearity issues among the indicators of formatively measured constructs. However, collinearity issues can also occur at lower VIF values of 3 (Mason and Perreault, 1991; Becker et al., 2015). Ideally, the VIF values should be close to 3 and lower.

In the third and final step, researchers need to assess the indicator weights’ statistical significance and relevance (i.e. size). PLS-SEM is a nonparametric method and therefore, bootstrapping is used to determine statistical significance (Chin, 1998). Hair et al. (2017a) suggest using BCa bootstrap confidence intervals for significance testing in case the bootstrap distribution of the indicator weights is skewed. Otherwise, researchers should use the percentile method to construct bootstrap-based confidence intervals (Aguirre-Urreta and Rönkkö, 2018). If the confidence interval of an indicator weight includes zero, this indicates that the weight is not statistically significant and the indicator should be considered for removal from the measurement model. However, if an indicator weight is not significant, it is not necessarily interpreted as evidence of poor measurement model quality. Instead, the indicator’s absolute contribution to the construct is considered (Cenfetelli and Bassellier, 2009), as defined by its outer loading (i.e. the bivariate correlation between the indicator and its construct). According to Hair et al. (2017a), indicators with a nonsignificant weight should definitely be eliminated if the loading is also not significant. A low but significant loading of 0.50 and below suggests that one should consider deleting the indicator, unless there is strong support for its inclusion on the grounds of measurement theory.

When deciding whether to delete formative indicators based on statistical outcomes, researchers need to be cautious for the following reasons. First, formative indicator weights are a function of the number of indicators used to measure a construct. The greater the number of indicators, the lower their average weight. Formative measurement models are, therefore, inherently limited in the number of indicator weights that can be statistically significant (Cenfetelli and Bassellier, 2009). Second, indicators should seldom be removed from formative measurement models, as formative measurement theory requires the indicators to fully capture the entire domain of a construct, as defined by the researcher in the conceptualization stage. In contrast to reflective measurement models, formative indicators are not interchangeable and removing even a single indicator can therefore, reduce the measurement model’s content validity (Diamantopoulos and Winklhofer, 2001).

After assessing the statistical significance of the indicator weights, researchers need to examine each indicator’s relevance. The indicator weights are standardized to values between −1 and +1, but, in rare cases can also take values lower or higher than this, which indicates an abnormal result (e.g. due to collinearity issues and/or small sample sizes). A weight close to 0 indicates a weak relationship, whereas weights close to +1 (or −1) indicate strong positive (or negative) relationships.
Assessing structural models

When the measurement model assessment is satisfactory, the next step in evaluating PLS-SEM results is assessing the structural model. Standard assessment criteria, which should be considered, include the coefficient of determination ($R^2$), the blindfolding-based cross-validated redundancy measure $Q^2$, and the statistical significance and relevance of the path coefficients. In addition, researchers should assess their model’s out-of-sample predictive power by using the PLSpredict procedure (Shmueli et al., 2016).

Structural model coefficients for the relationships between the constructs are derived from estimating a series of regression equations. Before assessing the structural relationships, collinearity must be examined to make sure it does not bias the regression results. This process is similar to assessing formative measurement models, but the latent variable scores of the predictor constructs in a partial regression are used to calculate the VIF values. VIF values above 5 are indicative of probable collinearity issues among the predictor constructs, but collinearity problems can also occur at lower VIF values of 3-5 (Mason and Perreault, 1991; Becker et al., 2015). Ideally, the VIF values should be close to 3 and lower. If collinearity is a problem, a frequently used option is to create higher-order models that can be supported by theory (Hair et al., 2017a).

If collinearity is not an issue, the next step is examining the $R^2$ value of the endogenous construct(s). The $R^2$ measures the variance, which is explained in each of the endogenous constructs and is therefore a measure of the model’s explanatory power (Shmueli and Koppius, 2011). The $R^2$ is also referred to as in-sample predictive power (Rigdon, 2012). The $R^2$ ranges from 0 to 1, with higher values indicating a greater explanatory power. As a guideline, $R^2$ values of 0.75, 0.50 and 0.25 can be considered substantial, moderate and weak (Henseler et al., 2009; Hair et al., 2011). Acceptable $R^2$ values are based on the context and in some disciplines an $R^2$ value as low as 0.10 is considered satisfactory, for example, when predicting stock returns (Raithel et al., 2012). More importantly, the $R^2$ is a function of the number of predictor constructs – the greater the number of predictor constructs, the higher the $R^2$. Therefore, the $R^2$ should always be interpreted in relation to the context of the study, based on the $R^2$ values from related studies and models of similar complexity. $R^2$ values can also be too high when the model overfits the data. That is, the partial regression model is too complex, which results in fitting the random noise inherent in the sample rather than reflecting the overall population. The same model would likely not fit on another sample drawn from the same population (Sharma et al., 2019a). When measuring a concept that is inherently predictable, such as physical processes, $R^2$ values of 0.90 might be plausible. Similar $R^2$ value levels in a model that predicts human attitudes, perceptions and intentions likely indicate an overfit.

Researchers can also assess how the removal of a certain predictor construct affects an endogenous construct’s $R^2$ value. This metric is the $f^2$ effect size and is somewhat redundant to the size of the path coefficients. More precisely, the rank order of the predictor constructs’ relevance in explaining a dependent construct in the structural model is often the same when comparing the size of the path coefficients and the $f^2$ effect sizes. In such situations, the $f^2$ effect size should only be reported if requested by editors or reviewers. If the rank order of the constructs’ relevance, when explaining a dependent construct in the structural model, differs when comparing the size of the path coefficients and the $f^2$ effect sizes, the researcher may report the $f^2$ effect size to explain the presence of, for example, partial or full mediation (Nitzl et al., 2016). As a rule of thumb, values higher than 0.02, 0.15 and 0.35 depict small, medium and large $f^2$ effect sizes (Cohen, 1988).

Another means to assess the PLS path model’s predictive accuracy is by calculating the $Q^2$ value (Geisser, 1974; Stone, 1974). This metric is based on the blindfolding procedure that
removes single points in the data matrix, imputes the removed points with the mean and estimates the model parameters (Rigdon, 2014b; Sarstedt et al., 2014). As such, the $Q^2$ is not a measure of out-of-sample prediction, but rather combines aspects of out-of-sample prediction and in-sample explanatory power (Shmueli et al., 2016; Sarstedt et al., 2017a). Using these estimates as input, the blindfolding procedure predicts the data points that were removed for all variables. Small differences between the predicted and the original values translate into a higher $Q^2$ value, thereby indicating a higher predictive accuracy. As a guideline, $Q^2$ values should be larger than zero for a specific endogenous construct to indicate predictive accuracy of the structural model for that construct. As a rule of thumb, $Q^2$ values higher than 0, 0.25 and 0.50 depict small, medium and large predictive relevance of the PLS-path model. Similar to the $f^2$ effect sizes, it is possible to compute and interpret the $q^2$ effect sizes. Many researchers interpret the $R^2$ statistic as a measure of their model’s predictive power. This interpretation is not entirely correct, however, as the $R^2$ only indicates the model’s in-sample explanatory power – it says nothing about the model’s out-of-sample predictive power (Shmueli, 2010; Shmueli and Koppius, 2011; Dolce et al., 2017). Addressing this concern, Shmueli et al. (2016) proposed a set of procedures for out-of-sample prediction that involves estimating the model on an analysis (i.e. training) sample and evaluating its predictive performance on data other than the analysis sample, referred to as a holdout sample. Their PLSpredict procedure generates holdout sample-based predictions in PLS-SEM and is an option in PLS-SEM software, such as SmartPLS (Ringle et al., 2015) and open source environments such as R (https://github.com/ISS-Analytics/pls-predict), so that researchers can easily apply the procedure.

PLSpredict executes $k$-fold cross-validation. A fold is a subgroup of the total sample and $k$ is the number of subgroups. That is, the total data set is randomly split into $k$ equally sized subsets of data. For example, a cross-validation based on $k = 5$ folds splits the sample into five equally sized data subsets (i.e. groups of data). PLSpredict then combines $k - 1$ subsets into a single analysis sample that is used to predict the remaining fifth data subset. The fifth data subset is the holdout sample for the first cross-validation run. This cross-validation process is then repeated $k$ times (in this example, five times), with each of the five subsets used once as the holdout sample. Thus, each case in every holdout sample has a predicted value estimated with a sample in which that case was not used to estimate the model parameters. Shmueli et al. (2019) recommend setting $k = 10$, but researchers need to make sure the analysis sample for each subset (fold) meets minimum sample size guidelines. Also, other criteria to assess out-of-sample prediction without using a holdout sample are available, such as the Bayesian information criterion (BIC) and Geweke and Meese (GM) criterion (discussed later in this paper).

The generation of the $k$ subgroups is a random process and can sometimes result in extreme partitions that potentially lead to abnormal solutions. To avoid such abnormal solutions, researchers should run PLSpredict multiple times. Shmueli et al. (2019) recommend to generally run the procedure ten times. However, when the objective is to duplicate how the PLS model will eventually be used to predict a new observation by using a single model (estimated from the entire data set), PLSpredict should be run only once (i.e. without repetitions).

For the PLSpredict based assessment of a model’s predictive power, researchers can draw on several prediction statistics that quantify the amount of prediction error. For example, the mean absolute error (MAE) measures the average magnitude of the errors in a set of predictions without considering their direction (over or under). The MAE is thus the
average absolute differences between the predictions and the actual observations, with all the individual differences having equal weight. Another popular prediction metric is the root mean squared error (RMSE), which is defined as the square root of the average of the squared differences between the predictions and the actual observations. As the RMSE squares the errors before averaging, the statistic assigns a greater weight to larger errors, which makes it particularly useful when large errors are undesirable – as is typically the case in business research applications.

When interpreting PLSpredict results, the focus should be on the model’s key endogenous construct, as opposed to examining the prediction errors for all endogenous constructs’ indicators. When the key target construct has been selected, the $Q^2_{predict}$ statistic should be evaluated first to verify if the predictions outperform the most naïve benchmark, defined as the indicator means from the analysis sample (Shmueli et al., 2019). Then, researchers need to examine the prediction statistics. In most instances, researchers should use the RMSE. If the prediction error distribution is highly non-symmetric, the MAE is the more appropriate prediction statistic (Shmueli et al., 2019). The prediction statistics depend on the indicators’ measurement scales and their raw values do not carry much meaning. Therefore, researchers need to compare the RMSE (or MAE) values with a naïve benchmark. The recommended naïve benchmark (produced by the PLSpredict method) uses a linear regression model (LM) to generate predictions for the manifest variables, by running a linear regression of each of the dependent construct’s indicators on the indicators of the exogenous latent variables in the PLS path model (Danks and Ray, 2018). When comparing the RMSE (or MAE) values with the LM values, the following guidelines apply (Shmueli et al., 2019):

- If the PLS-SEM analysis, compared to the naïve LM benchmark, yields higher prediction errors in terms of RMSE (or MAE) for all indicators, this indicates that the model lacks predictive power.
- If the majority of the dependent construct indicators in the PLS-SEM analysis produce higher prediction errors compared to the naïve LM benchmark, this indicates that the model has a low predictive power.
- If the minority (or the same number) of indicators in the PLS-SEM analysis yields higher prediction errors compared to the naïve LM benchmark, this indicates a medium predictive power.
- If none of the indicators in the PLS-SEM analysis has higher RMSE (or MAE) values compared to the naïve LM benchmark, the model has high predictive power.

Having substantiated the model’s explanatory power and predictive power, the final step is to assess the statistical significance and relevance of the path coefficients. The interpretation of the path coefficients parallels that of the formative indicator weights. That is, researchers need to run bootstrapping to assess the path coefficients’ significance and evaluate their values, which typically fall in the range of $-1$ and $+1$. Also, they can interpret a construct’s indirect effect on a certain target construct via one or more intervening constructs. This effect type is particularly relevant in the assessment of mediating effects (Nitzl, 2016).

Similarly, researchers can interpret a construct’s total effect, defined as the sum of the direct and all indirect effects. A model’s total effects also serve as input for the importance-performance map analysis (IPMA) and extend the standard PLS-SEM results reporting of path coefficient estimates by adding a dimension to the analysis that considers the average values of the latent variable scores. More precisely, the IPMA compares the structural model’s total effects on a specific target construct with the average latent variable scores of this construct’s predecessors (Ringle and Sarstedt, 2016).
Finally, researchers may be interested in comparing different model configurations resulting from different theories or research contexts. Sharma et al. (2019b, 2019a) recently compared the efficacy of various metrics for model comparison tasks and found that Schwarz’s (1978) BIC and Geweke and Meese’s (1981) GM achieve a sound trade-off between model fit and predictive power in the estimation of PLS path models. Their research facilitates assessing out-of-sample prediction without using a holdout sample, and is particularly useful with PLS-SEM applications based on a sample that is too small to divide it into useful analysis and holdout samples. Specifically, researchers should estimate each model separately and select the model that minimizes the value in BIC or GM for a certain target construct. For example, a model that produces a BIC value of \(-270\) should be preferred over a model that produces a BIC value of \(-150\). Table I summarizes the metrics that need to be applied when interpreting and reporting PLS-SEM results.

Robustness checks
Recent research has proposed complementary methods for assessing the robustness of PLS-SEM results (Hair et al., 2018; Latan, 2018). These methods address either the measurement model or the structural model (Table I).

In terms of measurement models, Gudergan et al. (2008) have proposed the confirmatory tetrad analysis (CTA-PLS), which enables empirically substantiating the specification of measurement models (i.e. reflective versus formative). The CTA-PLS relies on the concept of tetrads that describe the difference of the product of one pair of covariances and the product of another pair of covariances (Bollen and Ting, 2000). In a reflective measurement model, these tetrads should vanish (i.e. they become zero) as the indicators are assumed to stem from the same domain. If one of a construct’s tetrads is significantly different from 0, one rejects the null hypothesis and assumes a formative instead of a reflective measurement model specification. It should be noted, however, that CTA-PLS is an empirical test of measurement models and the primary method to determine reflective or formative model specification is theoretical reasoning (Hair et al., 2017a).

In terms of the structural model, Sarstedt et al. (2019) suggest that researchers should consider nonlinear effects, endogeneity and unobserved heterogeneity. First, to test whether relationships are nonlinear, researchers can run Ramsey’s (1969) regression equation specification error test on the latent variable scores in the path model’s partial regressions. A significant test statistic in any of the partial regressions indicates a potential nonlinear effect. In addition, researchers can establish an interaction term to map a nonlinear effect in the model and test its statistical significance using bootstrapping (Svensson et al., 2018).

Second, when the research perspective is primarily explanatory in a PLS-SEM analysis, researchers should test for endogeneity. Endogeneity typically occurs when researchers have omitted a construct that correlates with one or more predictor constructs and the dependent construct in a partial regression of the PLS path model. To assess and treat endogeneity, researchers should follow Hult et al.’s (2018) systematic procedure, starting with the application of Park and Gupta’s (2012) Gaussian copula approach. If the approach indicates an endogeneity issue, researchers should implement instrumental variables that are highly correlated with the independent constructs, but are uncorrelated with the dependent construct’s error term to explain the sources of endogeneity (Bascle, 2008). Importantly, however, endogeneity assessment is only relevant when the researcher’s focus is on explanation and rather not when following causal-predictive goals.

Third, unobserved heterogeneity occurs when subgroups of data exist that produce substantially different model estimates. If this is the case, estimating the model based on the entire data set is very likely to produce misleading results (Becker et al., 2013). Hence, any
Reflective measurement models

Reflective indicator loadings
Internal consistency reliability
- Cronbach’s alpha is the lower bound, the composite reliability is the upper bound for internal consistency reliability. $\rho_A$ usually lies between these bounds and may serve as a good representation of a construct’s internal consistency reliability, assuming that the factor model is correct.
- Minimum 0.70 (or 0.60 in exploratory research)
- Maximum of 0.95 to avoid indicator redundancy, which would compromise content validity
- Recommended 0.70-0.90
- Test if the internal consistency reliability is significantly higher (lower) than the recommended minimum (maximum) thresholds. Use the percentile method to construct the bootstrap-based confidence interval; in case of a skewed bootstrap distribution, use the BCa method

Convergent validity
- AVE $\geq 0.50$

Discriminant validity
- For conceptually similar constructs: HTMT $< 0.90$
- For conceptually different constructs: HTMT $< 0.85$
- Test if the HTMT is significantly lower than the threshold value

Formative measurement models

Convergent validity (redundancy analysis)
Collinearity (VIF)
- Probable (i.e. critical) collinearity issues when VIF $\geq 5$
- Possible collinearity issues when VIF $\geq 3.5$
- Ideally show that VIF $< 3$

Statistical significance of weights
- $p$-value $< 0.05$ or the 95% confidence interval (based on the percentile method or, in case of a skewed bootstrap distribution, the BCa method) does not include zero

Relevance of indicators with a significant weight
- Larger significant weights are more relevant (contribute more)

Relevance of indicators with a non-significant weight
- Loadings of $\geq 0.50$ that are statistically significant are considered relevant

Structural model
Collinearity (VIF)
- Probable (i.e. critical) collinearity issues when VIF $\geq 5$
- Possible collinearity issues when VIF $\geq 3.5$
- Ideally show that VIF $< 3$

R² value
- $R^2$ values of 0.75, 0.50 and 0.25 are considered substantial, moderate and weak. $R^2$ values of 0.90 and higher are typical indicative of overfit

Q² value
- Values larger than zero are meaningful
- Values higher than 0.25 and 0.50 depict small, medium and large predictive accuracy of the PLS path model

PLSpredict
- Set $k = 10$, assuming each subgroup meets the minimum required sample size
- Use ten repetitions, assuming the sample size is large enough
- $Q^2_{\text{predict}}$ values $> 0$ indicate that the model outperforms the most naive benchmark (i.e. the indicator means from the analysis sample)
- Compare the MAE (or the RMSE) value with the LM value of each

Table I. Guidelines when using PLS-SEM (continued)
PLS-SEM analysis should include a routine check for unobserved heterogeneity to ascertain whether or not the analysis of the entire data set is reasonable or not. Sarstedt et al. (2017b) proposed a systematic procedure for identifying and treating unobserved heterogeneity. Using information criteria derived from a finite mixture PLS (Hahn et al., 2002; Sarstedt et al., 2011), researchers can identify the number of segments to be extracted from the data (if any) (Hair et al., 2016; Matthews et al., 2016). If heterogeneity is present at a critical level, the next step involves running the PLS-prediction-oriented segmentation procedure (Becker et al., 2013) to disclose the data’s segment structure. Finally, researchers should attempt to identify suitable explanatory variables that characterize the uncovered segments (e.g., by using contingency table or exhaustive CHAID analyses; Ringle et al., 2010). If suitable explanatory variables are available, a moderator (Henseler and Fassott, 2010; Becker et al., 2018) or multigroup analysis (Chin and Dibbern, 2010; Matthews, 2017), in combination with a measurement invariance assessment (Henseler et al., 2016b), offers further particularized findings, conclusions and implications.

**Concluding observations**

PLS-SEM is increasingly being applied to estimate structural equation models (Hair et al., 2014). Scholars need a comprehensive, yet concise, overview of the considerations and metrics needed to ensure their analysis and reporting of PLS-SEM results is complete – before submitting their article for review. Prior research has provided such reporting guidelines (Hair et al., 2011; Hair et al., 2013; Hair et al., 2012b; Chin, 2010; Tenenhaus et al., 2005; Henseler et al., 2009), which, in light of more recent research and methodological developments in the PLS-SEM domain, need to be continuously extended and updated. We hope this paper achieves this goal.

For researchers who have not used PLS-SEM in the past, this article is a good point of orientation on when preparing and finalizing their manuscripts. Moreover, for researchers experienced in applying PLS-SEM, this is a good overview and reminder of how to prepare PLS-SEM manuscripts. This knowledge is also important for reviewers and journal editors to ensure the rigor of published PLS-SEM studies. We provide an overview of several recently proposed improvements (PLSpredict and model comparison metrics), as well as complementary methods for robustness checks (e.g., endogeneity assessment and latent class procedures), which we recommend should be applied – if appropriate – when using PLS-SEM. Finally, while a few researchers have published

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**Table I.**

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<tr>
<td><strong>Model comparisons</strong></td>
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<tr>
<td>Select the model that minimizes the value in BIC or GM compared to the other models in the set</td>
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<tr>
<td><strong>Robustness checks</strong></td>
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<tr>
<td>Measurement models</td>
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<td>CTA-PLS</td>
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<td>Structural model</td>
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<td>Nonlinear effects</td>
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<td>Endogeneity</td>
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<td>Unobserved heterogeneity</td>
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articles that are negative about the use of PLS-SEM, more recently several prominent researchers have acknowledged the value of PLS as an SEM technique (Petter, 2018). We believe that social science scholars would be remiss if they did not apply all statistical methods at their disposal to explore and better understand the phenomena they are researching.

References


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Dynamic capabilities
A morphological analysis framework and agenda for future research
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Abstract
Purpose – The growth, diversity and applications of research into dynamic capabilities (DCs) have resulted in the whole literature on DCs becoming a complex and disconnected body of knowledge. This has led to criticisms of the subject of DCs as being vague, tautological and without practical value. Hence, the purpose of this paper is to synthesize the diverse scholarly literature about DCs and develop a more integrated understanding to minimize the reported apparent vagueness.

Design/methodology/approach – In this paper, the authors review various relevant themes on DCs using a selection of 133 articles published in 22 recognized, top-tier management journals during the period between 1990 and 2016, with an aim to build a structured and integrated theory. For this, morphological analysis (MA), a systems-thinking technique, is applied.

Findings – MA is applied to develop a multi-dimensional conceptual framework comprising five dimensions and 26 variants that enable a structured representation of the conceptual foundations of DCs. Further, the authors identify 81 individual DCs noted by various scholars; elucidate assumptions and antecedents relevant to the DCs approach; structure the key characteristics; and expound the input factors, impacting factors, desired outcomes and assessment yardsticks.

Research limitations/implications – This would be a useful resource for researchers working in the area of DCs to explore opportunities for future research.

Practical implications – The MA framework helps managers to look at DCs more holistically, and hence would help them in developing, managing and retaining DCs in organizations.

Originality/value – This study is the original work contributed by the authors and has no specific organizational reference. This research implies new directions to look beyond individual DCs in firms toward a more integrated theory building.

Keywords Dynamic capabilities, Conceptual framework, Morphological analysis, Integrated theory

Paper type Literature review

1. Introduction
The dynamic capabilities (DCs) approach to strategic management (Mintzberg, 1987) has attracted increasing attention within management literature in recent years. The early foundations of the DCs approach emerged from Schumpeterian theories of innovation-based competition, price–performance rivalry, increasing returns and the creative destruction of existing competencies (Teece et al., 1997). Encapsulating the wisdom from other works on creating competitive advantage in firms, including the competitive forces (CF) approach (Porter, 1985), core competencies (CC) approach (Prahalad and Hamel, 1990) and the resource-based (RB) approach (Wernerfelt, 1984; Barney, 2001), the DCs approach has evolved into a distinct body of knowledge for scholarly research since its beginnings (Teece and Pisano, 1994). Firms are facing increasing challenges to sustain competitive advantage in the wake of corporate turbulence, especially in hypercompetitive markets (Wiggins and
Ruefl, 2005). Hence, they should be ready to understand, align and imbibe various technologies and deal with environmental changes.

Operational capabilities (otherwise called as ordinary capabilities) have been identified as one of the key drivers of firm-level performance. However, they behave as organizational static routines for day-to-day delivery of products or services. They cannot create a sustained competitive advantage, as they seldom interact with the environment (Winter, 2003; Wang and Ahmed, 2007; Zahra et al., 2006). Consciously created higher-order capabilities with unique attributes to build, integrate or reconfigure the operational capabilities, while interacting with the environment, are termed as “Dynamic Capabilities” (DCs) which can create sustained competitive advantage in firms (Pisano, 1994; Henderson and Cockburn, 1994; Teece and Pisano, 1994; Grant, 1996). The DCs approach which addresses this important aspect of strategic management is, thus, crucial to both managers and researchers.

Many contemporary thinkers in the researcher and practitioner communities have widely accepted this approach. According to a recent study, more than 1,500 published articles appeared in the ABI/INFORM database during 1997 to 2007 on the DCs approach (Barreto, 2010). The growth, diversity and applications of research into DCs have led to significant interest in this field within the mainstream of management and business administration, beyond its original domain of strategic management. Peteraf et al. (2012) observed that there are contradictory understandings about the DCs approach by management thinkers. Wang and Ahmed (2007) highlighted that past research on DCs was conducted in a piece-meal basis, with disconnected research findings. Barreto (2010) pointed out that even the definitions of DCs by various management thinkers varied in terms of the nature, specific role, relevant context, creation and evolution mechanisms, clearly highlighting the lack of coherence in the body of knowledge. These drawbacks perhaps led to consequent arguments by critics that the DCs approach as vague and tautological and does not have practical value (Williamson, 1999; Kraatz and Zajac, 2001; Davis, 2004; Zahra et al., 2006; Newbert, 2007; Levinthal and Ocasio, 2007; Arend and Bromiley, 2009). Hence, there is a need to synthesize the diverged literature on DCs to gain a more integrated understanding.

We aim to use morphological analysis (MA), a “systems thinking” technique, to represent the conceptual foundations of the subject of DCs in the form of a multi-dimensional conceptual framework. The resulting MA framework – a multi-dimensional tabular structured representation of all the relevant terminologies, concepts and their extant variations – is based on the key conceptual and empirical articles on the DCs approach published in top-tier management journals from its beginnings in the 1990s till 2016. It supports the development of an integrated theory and helps minimize the reported vagueness. A total of five dimensions and 26 variants were identified from the relevant literature for the construction of the framework. Further, we seek to: clarify various definitions of DCs; identify 81 individual DCs reported by various thinkers; elucidate the assumptions and antecedents behind the concept of the DCs approach and their key characteristics; expound the input variants (organizational resources and processes), impacting factors (endogenous, exogenous and interrelated), desired outcomes (short and long term) and assessment yardsticks of the DCs approach in firms. The paper concludes with directions for future research.

2. Theoretical background and motivation

2.1 An evolution in management thinking toward creating competitive advantage in firms

Many management thinkers have suggested various approaches to create competitive strategies. The early attempts of such thinking focused on SWOT (the acronym for
strengths, weaknesses, opportunities and threats) analysis, the origins of which remain obscure. Though SWOT analysis was perceived helpful, Porter argued that it would be unsuitable and ad hoc for strategic planning (Porter et al., 2002). Earlier, Porter (1980, 1985) suggested the CF approach as an inward-out mechanism relating a company to its environment to tackle its competition and provide above-average returns in the long run. According to him, to achieve competitive advantage, firms should focus on developing a strategy considering five forces, namely, the threat of substitutes for products or services, the threat from established rivals, the threat from new entrants, the bargaining power of suppliers and the bargaining power of customers. The CF approach can be used to help firms in an industry to find a position from which they can best defend themselves against competitive forces or influence them in their favor. A few thinkers criticized Porter’s generic strategies and CF approach as mere tautology, and not a reflection of generic practices in the real business world (Murray, 1988; Tang and Liou, 2010).

Later, Prahalad and Hamel (1990) proposed the CC approach with a focus on collective learning in employees and development of strategic capabilities to integrate different technologies through cross-functional management and collaborative working. According to the CC approach, CC provide competitive advantage to firms by providing potential access to a wide variety of markets, making a significant contribution to the perceived customer benefits of the end product/services. Also, they are difficult to be imitated by competitors. However, the CC approach missed the point that it is not the CC themselves that provide competitive advantage, instead of stressing how the core capabilities dynamically influence core competencies that really count (Stalk et al., 1992). Barney (1991) argued that a competitive advantage is sustainable only when the efforts by competitors have ceased to render the competitive advantage redundant, as an outward-in mechanism. He emphasized that a firm is said to have a competitive advantage when it is implementing a strategy not simultaneously being implemented by any current or potential players. When the imitative actions come to an end without disrupting the firm’s competitive advantage, the firm’s strategy can be called sustainable.

According to the RB approach, the competitive advantage of a firm lies primarily in the application of a bundle of valuable tangible or intangible resources at the firm’s disposal (Wernerfelt, 1984). It explains that a firm’s sustainable competitive advantage is reached by virtue of its unique resources being rare, valuable, inimitable, non-tradable and non-substitutable, as well as firm-specific (Barney, 2001; Makadok, 2001). Amit and Schoemaker (1993) argued that competitive strategies could be created and sustained not merely by a firm’s capabilities or resources, but as a combination of both. They defined “resources” as tradable entities non-specific to the firm, while “capabilities” are firm-specific and used to engage the resources within the firm. Makadok (2001) highlighted the difference between capabilities and resources by defining capabilities as a special type of resource whose purpose is to improve the productivity of the other resources possessed by a firm. Sirmon et al. (2007) added that the strategic bundling of resources builds capabilities in the firm. According to a few contemporary thinkers, the RB approach is considered to be static in its nature, and hence inadequate to explain a firm’s competitive advantage in changing environments (Teece and Pisano, 1994; Priem and Butler, 2001; Barreto, 2010).

According to Teece et al. (1997), the CF, CC and RB approaches with firm-specific capabilities and resource-based strategies are not sufficient to create sustainable competitive advantage, given the dynamic environments, dependencies and market positions. They argue that a firm’s competitive strategy cannot be static to sustain its competitive advantage. A few contemporary thinkers supported this view and affirmed that the static routines of a firm are mere operational capabilities for generating transactional output. In a
“dynamic context”, firms continuously learn from their environments, enabling managers to acquire, shed, integrate and recombine these operational capabilities to generate desired outcomes. Consciously created firm-level capabilities with unique attributes to build, integrate or reconfigure the operational capabilities are termed as “Dynamic Capabilities” (DCs), which can be used to create sustained competitive advantage for firms (Grant, 1996; Pisano, 1994; Henderson and Cockburn, 1994). Strategy researchers have used the term “Red Queen Effect” to describe competitive advantage as a function of competitive actions between a firm and its rivals and further emphasized the need for DCs to be adapted to and evolved faster than competitors to sustain competitive advantage (Su et al., 2014). This DC approach has attracted increasing attention in management literature in recent years.

2.2 The dynamic capabilities approach

The founding thinkers (Teece et al., 1997) defined the DCs approach as a firm’s ability to alter its resource configurations by applying certain capabilities for adapting to changing environments and to achieve new forms of competitive advantage. The term “Dynamic” refers to the capacity to renew existing competencies so as to achieve flexibility while dealing with a changing environment. The term “Capabilities” emphasizes the key role of strategic management in appropriately adapting, integrating and reconfiguring internal and external organizational resources and competencies to match the requirements of changing environments or even influence them in desired ways. Teece and Pisano (1994) suggested that a firm’s DCs are determined by: processes – managerial and organizational “routines”; positions – current endowments of technology, customer bases and suppliers; and paths – available strategic alternatives. The term “Capability”, in the strategic context of a firm, should serve two fundamental purposes, namely, performance and coordination of activities (Helfat and Peteraf, 2003).

In other words, the capability of an organization means that it has reached some minimum level of functionality that permits repeated and reliable performance of an activity, in contrast to ad hoc activity that does not reflect practiced or patterned behavior. The magnitude of the capability could vary from firm to firm for the same functionality. For example, in the e-commerce industry, firms like Amazon, E-bay and Alibaba.com all have effective online-sales service capability at different levels of functionalities. Literature features the fundamental difference between operational capabilities and DCs. Winter (2000) defines operational capabilities as merely high-level routines such as manufacturing a particular product, processing a transaction, etc., whereas DCs are unique capabilities that do not involve production of a good or provision of a marketable service, rather they build, integrate or reconfigure the existing operational capabilities of the firm (Helfat and Peteraf, 2003). DCs work differently than operational capabilities, which are generally static and operate independently. Hence, DCs cannot be easily replicated, integrated or imitated by competitors. They cannot be transferred, in a complete sense, between different firms because of the attendant interdependencies in the firms’ resources, routines and systems, all of which make it impossible to change one without another. Enterprises with stronger DCs are more flexible and adaptive to changing environments, and hence more successful too (Teece, 2014). Thus, DCs provide a foundation for sustaining competitive advantage over time (Teece, 2007). Several alternative conceptualizations of DCs were subsequently offered by various thinkers. A few of these key definitions are featured in Table I. These definitions vary in terms of the nature, creation, evolution mechanisms and relevant context.
2.3 Examples of DCs

Teece and Pisano (1994) highlighted the example of the lean production system as a DC in Fujimoto Inc. By deploying lean, they adapted distinctive shop-floor practices and processes cutting across skilled resources, principles and systems of the firm contributing a culture of continuous improvement (Sunder, 2016). It could be argued that lean has been adapted by many other firms today, but every firm’s lean practice is unique and based on its interlock with its routines and resources. Another example could be Canon which uses its expertise in optics to serve markets as diverse as cameras, copiers and semi-conductor equipment.
Canon’s competitive advantage is, thus, a result of its policy management across markets, which is not easily seen or understood by its rivals (Witcher et al., 2008). Canon does use collaborative forms of cross-functional management, through Hoshin Kanri (policy management) which served them as a DC to meet this purpose. Another example, implied through the case of Coca-Cola in India which has enjoyed great success due to their product branding DCs, concerns the challenge they faced due to the rapidly reducing groundwater. The government began shutting down Coca-Cola plants in India in 2010. Learning from the demand and the dynamics of the environment, the company devised ways of saving water, including rain water harvesting, and started branding themselves as a socially responsible organization, which further increased their success in the Indian market (Financial Times, 2014). Similar to these, we have identified 81 such individual DCs (featured in Table II) reported by various thinkers. Though a few authors have aggregated the relevant DCs, like managerial DCs, marketing DCs, etc., we have presented them as individual items in Table II to enable readers’ ease of understanding. This representation does not argue or test whether these are DCs or are not. Here, we agree with the reported scholarly literature that these are individual DCs, despite the debates therein. However, some critics of the DCs approach could disagree.

2.4 Criticisms of the DCs approach
Despite the substantial body of work that endorsed DCs, the approach has been subject to some strong criticisms. This may be due to differing versions, which are loosely structured together, in the development of DCs literature. For example, when introducing the concept of DCs, Teece and Pisano (1994) referred to the “processes, positions and paths” as strategic dimensions of a firm. Later, Teece et al. (1997) then stated that DCs lie “embedded within the firm’s processes”. In a more recent paper, Teece has disaggregated DCs into three capacities for practice: sensing, seizing and reconfiguration (2007), to exercise inside-out capacities to the edges of a firm’s internal and external environment. Kraatz and Zajac (2001) stated that, while the concept of DCs is appealing, it is apparently vague and elusive, and has thus far proven largely resistant to observation and measurement. Further, Davis (2004) claimed that most of the research publications on DCs were primarily conceptual rather than empirical, while excluding certain immeasurable capabilities, which could be crucial for a firm. This contradicts the fact of real-time applications of DCs. Even recently, Newbert (2007) conducted empirical tests on a limited set of firms by using the DCs approach and concluded that there was only a low level of support for the concept. Arend and Bromiley (2009) criticized the DCs approach as unclear, accompanied by a lack of coherent theoretical foundation, that it yielded lower value addition than existing concepts. They opposed Rindova and Kotha’s study (2001) which claimed Yahoo! and Excite possessed DCs. Arend and Bromiley (2009) criticized that Yahoo! never had positive operating income during their study period, and Yahoo! lost over 99 per cent of its market value during the dotcom bust. However, these claims were strongly opposed by Helfat et al. (2007) and Helfat and Peteraf (2009), who argued that “Arend and Bromiley (2009) failed to see ‘deficiencies’ or the tell-tale signs on early-stage development of an area of inquiry”, and that well-established DCs may be developed slowly. Though the seminal characteristics of DCs continues to be questioned (Peteraf et al., 2012), the opportunities for further research are quite open considering the concept’s ongoing developing path.

2.5 Our motivation for this study
We draw motivation from both, the importance of the DCs approach and criticisms against it. Firstly, we aim to test, through methodological analysis, the claims made by a few
<table>
<thead>
<tr>
<th>Individual DCs</th>
<th>Sample papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>New product development</td>
<td>Helfat (1997); McKelvie and Davidsson (2009); Bruni and Verona (2009); Fawcett et al. (2011)</td>
</tr>
<tr>
<td>Relational capability</td>
<td>Lorenzoni and Lipparini (1999), Capaldo (2007)</td>
</tr>
<tr>
<td>Alliance formation and alliance learning</td>
<td>Gulati (1999); Kale and Singh (2007); Jiang (2010); Schilke (2014)</td>
</tr>
<tr>
<td>Building relational DCs</td>
<td>Lorenzoni and Lipparini (1999), Capaldo (2007); Donada et al. (2016)</td>
</tr>
<tr>
<td>Change management capability</td>
<td>Savolainen (1999)</td>
</tr>
<tr>
<td>Idea generation and continuous process improvement</td>
<td>Savolainen (1999); Pablo et al. (2007), Anand et al. (2009)</td>
</tr>
<tr>
<td>Process risk management</td>
<td>Gulati (1999); Heimeriks et al. (2012), Dixon (2014)</td>
</tr>
<tr>
<td>Inter-organizational networking and collaboration</td>
<td>Dyer and Nobeoka (2000), Fawcett et al. (2011); Kleinbaum and Stuart (2014)</td>
</tr>
<tr>
<td>Top executive’s cognitive capability and style</td>
<td>Carpenter et al. (2001), Kor and Mesko (2013)</td>
</tr>
<tr>
<td>Shifting bases and markets</td>
<td>Rindova and Kotha (2001)</td>
</tr>
<tr>
<td>Talent hiring</td>
<td>Carpenter et al. (2001)</td>
</tr>
<tr>
<td>Continuous morphing</td>
<td>Rindova and Kotha (2001)</td>
</tr>
<tr>
<td>Re-engineering</td>
<td>Zollo and Winter (2002)</td>
</tr>
<tr>
<td>Absorptive capacity</td>
<td>Zahra and George (2002), Lichtenhalter (2009); Saenz et al. (2014)</td>
</tr>
<tr>
<td>Exploitative capability</td>
<td>Zahra and George (2002)</td>
</tr>
<tr>
<td>Post-acquisition integration</td>
<td>Zollo and Winter (2002), Heimeriks et al. (2012)</td>
</tr>
<tr>
<td>Capability to create DCs</td>
<td>Helfat and Peteraf (2003), Bingham et al. (2015)</td>
</tr>
<tr>
<td>Explorative capability</td>
<td>Benner and Tushman (2003), Daneeels (2008); Saenz et al. (2014)</td>
</tr>
<tr>
<td>Talent management capability</td>
<td>Adner and Helfat (2003); Sirmon and Hitt (2009)</td>
</tr>
<tr>
<td>Project and program management</td>
<td>Mosey (2005); Anand et al. (2009)</td>
</tr>
<tr>
<td>Strategic planning and strategy formulation</td>
<td>Slater et al. (2006)</td>
</tr>
<tr>
<td>Product heterogeneity</td>
<td>Pil and Cohen (2006)</td>
</tr>
<tr>
<td>Alliance management</td>
<td>Kale and Singh (2007), Jiang et al. (2010); Anand et al. (2010); Schilke (2014); Wang and Rajagopalan (2015)</td>
</tr>
<tr>
<td>Resource divestment</td>
<td>Harreld et al. (2007)</td>
</tr>
<tr>
<td>Organizational adaptability and continuous learning</td>
<td>Schreyogg and Kliesch-Eberl (2007); Hanson et al. (2011), Li et al. (2015)</td>
</tr>
<tr>
<td>Organizational alignment</td>
<td>Schreyogg and Kliesch-Eberl (2007); Hanson et al. (2011)</td>
</tr>
<tr>
<td>Product/process innovation</td>
<td>Smart et al. (2007), Capaldo (2007); Galunic and Eisenhardt (2001)</td>
</tr>
<tr>
<td>Knowledge management capability</td>
<td>Wang et al. (2007), Smart et al. (2007)</td>
</tr>
<tr>
<td>Best practice creation</td>
<td>Peteraf and Reed (2007)</td>
</tr>
<tr>
<td>Metacognition, managerial awareness, discretion, and perception</td>
<td>Peteraf and Reed (2007), Essex et al. (2016)</td>
</tr>
<tr>
<td>Performance management</td>
<td>Wang et al. (2007), Hanson et al. (2011)</td>
</tr>
<tr>
<td>Strategic political management</td>
<td>Oliver and Holzinger (2008)</td>
</tr>
<tr>
<td>Institutional influencing capability</td>
<td>Oliver and Holzinger (2008)</td>
</tr>
<tr>
<td>Policy management</td>
<td>Witcher et al. (2008)</td>
</tr>
</tbody>
</table>

Table II. Individual dynamic capabilities (in order of appearance in research literature)
<table>
<thead>
<tr>
<th>Individual DCs</th>
<th>Sample papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental scanning and predictive capability</td>
<td>Danneels (2008), Oliver and Holzinger (2008)</td>
</tr>
<tr>
<td>Design creativity</td>
<td>Azadegan et al. (2008)</td>
</tr>
<tr>
<td>Business excellence</td>
<td>Witcher et al. (2008)</td>
</tr>
<tr>
<td>Training and development</td>
<td>Azadegan et al. (2008)</td>
</tr>
<tr>
<td>Ability to study new markets and market disruptions</td>
<td>Danneels (2008), McKelvie and Davidsson, (2009)</td>
</tr>
<tr>
<td>Lean capability</td>
<td>Shah and Ward (2007), Anand et al. (2009); Secchi and Camuffo (2016)</td>
</tr>
<tr>
<td>Six sigma capability</td>
<td>Anand et al. (2009)</td>
</tr>
<tr>
<td>Reverse engineering</td>
<td>Malik and Kotabe (2009)</td>
</tr>
<tr>
<td>Experimentation capability</td>
<td>Ambrosini et al. (2009), Dixon et al. (2014)</td>
</tr>
<tr>
<td>Transformative learning</td>
<td>Lichtenthaler (2009), Newey and Zahra (2009)</td>
</tr>
<tr>
<td>Communication and social cognition</td>
<td>Morgan et al. (2009), Helfat and Peteraf (2015)</td>
</tr>
<tr>
<td>Resource management</td>
<td>Simon and Hitt (2009)</td>
</tr>
<tr>
<td>Manufacturing flexibility</td>
<td>Malik and Kotabe (2009); Scherrer-Rathje et al. (2014)</td>
</tr>
<tr>
<td>Pricing</td>
<td>Morgan et al. (2009)</td>
</tr>
<tr>
<td>Distribution capability</td>
<td>Morgan et al. (2009)</td>
</tr>
<tr>
<td>Advertising and marketing communications</td>
<td>Morgan et al. (2009)</td>
</tr>
<tr>
<td>Information technology management</td>
<td>Anand et al. (2010), Fawcett et al. (2011)</td>
</tr>
<tr>
<td>Infrastructure technology management</td>
<td>Anand et al. (2010)</td>
</tr>
<tr>
<td>Intra and inter cultural capability</td>
<td>Moon (2010)</td>
</tr>
<tr>
<td>Customer orientation</td>
<td>Zhou and Li (2010)</td>
</tr>
<tr>
<td>Fixed assets managing capability</td>
<td>Tang and Liou (2010)</td>
</tr>
<tr>
<td>Managerial attention</td>
<td>Martin (2011); Helfat and Peteraf (2015)</td>
</tr>
<tr>
<td>Resource allocation</td>
<td>Coen and Maritan (2011)</td>
</tr>
<tr>
<td>Metrics management</td>
<td>Hanson et al. (2011)</td>
</tr>
<tr>
<td>Strategic agility and flexibility</td>
<td>Chiang et al. (2012), Weber and Tarba (2014)</td>
</tr>
<tr>
<td>Supply chain agility</td>
<td>Chiang et al. (2012), Blome et al. (2013); Li et al. (2015)</td>
</tr>
<tr>
<td>Concurrent learning</td>
<td>Eggers (2012), Bingham et al. (2015)</td>
</tr>
<tr>
<td>Product portfolio management</td>
<td>Eggers (2012)</td>
</tr>
<tr>
<td>Re-organization, restructuring and reconfiguration</td>
<td>Vanpoucke et al. (2014); Girod and Whittington (2016); Fainshmidt and Frazier (2016)</td>
</tr>
<tr>
<td>Outsourcing capability</td>
<td>Scherrer-Rathje et al. (2014)</td>
</tr>
<tr>
<td>Reconfiguration</td>
<td>Vanpoucke et al. (2014); Fainshmidt and Frazier (2016)</td>
</tr>
<tr>
<td>Supplier integration</td>
<td>Vanpoucke et al. (2014)</td>
</tr>
<tr>
<td>Managing demand uncertainty</td>
<td>Barrales-Molina et al. (2014); Li et al. (2015)</td>
</tr>
<tr>
<td>Customer relationship management</td>
<td>Barrales-Molina et al. (2014); Vanpoucke et al. (2014)</td>
</tr>
<tr>
<td>Brand building</td>
<td>Barrales-Molina et al. (2014)</td>
</tr>
<tr>
<td>Business risk management</td>
<td>Dixon et al. (2014)</td>
</tr>
<tr>
<td>Problem-solving and reasoning</td>
<td>Helfat and Peteraf (2015)</td>
</tr>
<tr>
<td>Corporate social responsibility</td>
<td>Sodhi (2015)</td>
</tr>
<tr>
<td>Stakeholders management</td>
<td>Sodhi (2015)</td>
</tr>
</tbody>
</table>

Table II.
scholars that DCs research is non-empirical and predominantly conceptual. Secondly, as many scholars have judged the DCs approach to be vague, unstructured and tautological, we aim to develop a structure to represent the existing DCs literature by developing a holistic framework using MA for enabling the development of meaningful theory. Against the background of all the adverse criticisms of DCs, we aim to present a structured theoretical foundation for the DCs approach with an agenda for future research.

3. Method
We have studied the published research literature on DCs from relevant top-tier management journals and analyzed the data. Systematic review has become a fundamental scientific activity, essential for deriving intellectual value for strengthening a body of knowledge (Tranfield et al., 2003). We have performed an extensive online search in top-tier management journals (see Table III for the list of journals) in their individual website databases, using the keyword “Dynamic Capability/Capabilities” on publications from 1990 to 2016, and identified 171 papers. After eliminating the duplicates and studying the abstracts, 133 papers across 21 recognized, top-tier scholarly journals were identified as relevant to the subject. However, it is possible that a few papers may exist that were unintentionally not investigated as a part of this study. Table III shows an increasing interest in research publications pertaining to the DCs approach.

Table IV presents an overview of the methodological analysis. In all, 38 theoretical papers and 95 empirical studies have appeared. This effectively counters the criticism that the DCs approach is non-empirical, as 71 per cent of the total reviewed papers have used empirical methods of research. The theoretical publications included conceptual or desk analysis by various researchers. The empirical papers limited to descriptive and

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Strategic Management Journal</td>
<td>47</td>
<td>9</td>
<td>6</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>British Journal of Management</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Journal of Operations Mgmt.</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Organization Science</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Academy of Management Journal</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Academy of Management Review</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journal of Management Studies</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academy of Management Perspectives</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>International Journal of Management Reviews</td>
<td>4</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Journal of Business Research</td>
<td>4</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>International Journal of Production Research</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>California Management Review</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Journal of Management</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Journal of Operations Management</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Long Range Planning</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Organization</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journal of Supply Chain Management</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group and Organization Management</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Organization Studies</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production and Operations Management</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production Planning and Control</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>133</strong></td>
<td><strong>10</strong></td>
<td><strong>16</strong></td>
<td><strong>48</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>
experimental studies were further classified based on the data collection methods used. In total, 55 papers appeared to have used primary data collection methods. The primary data category comprising 40 papers is dominated by case studies and questionnaires. In the remaining 15 papers, this category also includes the use of experiments, interviews, interviews based on questionnaires, pilot surveys and field visits, questionnaires and questionnaires with field visit data sources. Thus, we can observe that there is a need for more empirical research that considers non-case-study and questionnaire survey methods. There were only 32 papers that leveraged secondary data from existing literature and public data sources. The use of multiple primary research methods (mixed methods) was found in eight of the reviewed papers.

<table>
<thead>
<tr>
<th>Research method</th>
<th>No. of papers</th>
<th>(%) papers</th>
<th>Sample papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical (conceptual)</td>
<td>38</td>
<td>29</td>
<td>Teece et al. (1997), Eisenhardt and Martin (2000); Winter (2003), Helfat and Peteraf (2015)</td>
</tr>
<tr>
<td>Empirical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case study</td>
<td>19</td>
<td>14</td>
<td>Rindova and Kotha (2001); Zott (2003); Wollersheim and Heimeriks (2016)</td>
</tr>
<tr>
<td>Experiment</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Interviews</td>
<td>1</td>
<td>1</td>
<td>Capaldo (2007)</td>
</tr>
<tr>
<td>Interviews and questionnaire</td>
<td>5</td>
<td>4</td>
<td>Wilden et al. (2003); Heimeriks et al. (2012)</td>
</tr>
<tr>
<td>Interviews, pilot survey and field visits</td>
<td>2</td>
<td>2</td>
<td>Gulati (1999); Marcus and Anderson (2006)</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>21</td>
<td>16</td>
<td>Døving and Gooderham (2008); Blome et al. (2013), Fainshmidt and Frazier (2016)</td>
</tr>
<tr>
<td>Questionnaire and field visits</td>
<td>2</td>
<td>2</td>
<td>Machar and Mowery (2009), Schilke (2014)</td>
</tr>
<tr>
<td>Others (Public data sources)</td>
<td>21</td>
<td>16</td>
<td>Lee (2008); Shamsie et al. (2009), Ross and Sharapov (2015)</td>
</tr>
<tr>
<td>Mixed methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature and interviews</td>
<td>4</td>
<td>3</td>
<td>Smart (2007), Bititci et al. (2011)</td>
</tr>
<tr>
<td>Questionnaire and public data sources</td>
<td>1</td>
<td>1</td>
<td>Li et al. (2015)</td>
</tr>
<tr>
<td>Interviews and public data sources</td>
<td>2</td>
<td>2</td>
<td>Newey and Zahra (2009), Stadler et al. (2013)</td>
</tr>
<tr>
<td>Case study, interviews, public data sources</td>
<td>1</td>
<td>1</td>
<td>Martin (2011)</td>
</tr>
</tbody>
</table>

Table IV.
Methodological classification of reviewed papers
A Microsoft Excel database was formed for classifying these 133 articles into different headings for the purpose of analyzing the trends in the body of knowledge. Further, the full papers were read and the existing literature classified into the MA framework developed for structuring the various loosely packed concepts in the DCs literature and eliminating the reported vagueness. This makes for the theoretical contributions to the body of knowledge constituting DCs. The inferences derived from the MA framework have been used to conceptualize a model of the DCs approach for identifying further theoretical and practical implications.

4. Theoretical framework using morphological analysis (MA)

4.1 A brief introduction to MA

MA is a qualitative analytical technique used for investigating and structuring the total set of relationships contained in multi-dimensional, non-quantifiable contexts to eliminate vagueness (Zwicky, 1969; Ritchey, 2011). MA provides a method to identify and investigate elements of a system (or a concept) in its existing form and to present a holistic conceptual system (Majer, 2007). Using this method, the entire set of unstructured concepts is put into a framework, defined by a set of “dimensions” representing the ontological structural components of the concept being studied and “variants” representing the extant, as well as possible ontological manifestations corresponding to each of the dimensions. The “variants” are a logical set of attributes that could vary in magnitude based on the context of the MA. These “dimensions” and their respective “variants” make up a structured conceptual system, which by design minimizes or may even eliminate vagueness in the unstructured concept under study. It is important to note that the development of an MA framework demands judgment, and it is quite likely that different authors may develop different MA frameworks even from the same literature they use to represent the same unstructured concept. However, the aggregated contents of all such MA frameworks will theoretically be the same, although the form of representations could vary. This indicates the objectivity of the approach toward theory building through a systems thinking perspective. Scholars from social sciences, economics and operations management have used this technique for building structured theories for vaguely defined concepts and generating new ideas for research (Sunder et al., 2018). Researchers in the field of strategic management will benefit from the use of MA, and this work may perhaps be the first of its kind involving the use of MA for representing the presently loosely structured concept of DCs.

4.2 The MA framework representation of DCs: “dimensions” and “variants”

After reading the 133 scholarly papers selected for this work, we have categorized various themes in the DCs literature into the following five dimensions, namely, building blocks of DCs, input variants for building DCs, influencing factors that impact DCs, desired outcomes of DCs and assessment yardsticks for DCs. Further, 26 relevant variants were identified in these dimensions, including sub-dimensions wherever applicable. The complete MA framework representation is given in Figure 1[2], and the dimensions and variants are discussed below in detail.

5. Dimension 1: building blocks of DCs

The DCs concept has been built over a few assumptions or pre-requisites and has also been characterized. This section provides an overview of these assumptions and characteristics of DCs.
5.1 Variant 1: assumptions behind the DCs approach

Overcoming the limitation of RBA, which assumes that the organization being a bundle of resources breaks down in high-velocity markets, the DCs approach is built on micro foundations of strategic imperatives of change. These assumptions are fundamental
justifications for the existence of DCs theory. The assumptions are listed below along with related, brief discussions.

Assumption 1: Ordinary or operational capabilities exist in organizations.
Assumption 2: Markets and firms operate in a Schumpeterian world.
Assumption 3: Modularity exists in a firm’s systems.
Assumption 4: Necessary resources are available for a firm’s operations.
Assumption 5: The fundamental units of analysis of a firm are processes, positions and paths.

Firstly, scholars have recognized the existence of ordinary or operational capabilities in organizations, which are routines that enable a firm to perform an activity on an on-going basis maintaining status quo. Examples include manufacturing a product, providing call center services, etc., (Helfat and Peteraf, 2003; Drnevich and Kriauciunas, 2011; Helfat and Winter, 2011; Stadler et al., 2013; Karna et al., 2016; Essex et al., 2016; Fainshmidt et al., 2016). On the other hand, DCs enable a firm to alter its operational capabilities or resource base or some features of its external environment to facilitate strategic management. Examples of DCs include alliance management, new product development, outsourcing, talent management, etc. Hence, operational capabilities serve as building blocks for DCs. Secondly, the DCs body of knowledge gains reliability based on the assumption that markets and firms operate in a Schumpeterian world (Teece, 1997; Peteraf et al., 2013). This is because the DCs approach has been built upon the theoretical foundations provided by Schumpeter (1934), which emphasizes the necessity of creative destruction to constantly create environments of change. Another key assumption behind the DCs approach is that modularity exists in a firm’s systems. This enables managing complexity and designing flexible organizational and technological systems as per the environmental undercurrents (Pil and Cohen; 2006). The availability of necessary resources is a pre-requisite for the existence of DCs in a firm (Helfat and Peteraf, 2003). The fundamental resources consist of human, financial, infrastructure and technological, information, knowledge and organizational systems and networks and relationships. Finally, the DCs theory is built on the assumption that the fundamental units of analysis of firms are processes, positions and paths (Teece et al., 1997). These assumptions not only serve as foundation to the DCs theory, but in their absence, the concept of DCs would be meaningless.

5.2 Variant 2: Characteristics of DCs
Further to the above assumptions or pre-requisites, there are several characteristics that DCs exhibit (see Table V). These characteristics also form part of the building blocks of the concept of DCs, as they typically define what a DC could be. In other words, an organizational capability which does not exhibit these characteristics is considered merely static in nature. Though all DCs exhibit these characteristics, the intensity or magnitude of their presence vary from across DCs and across firms based on various endogenous and exogenous factors. Hence, we have defined these characteristics as a “degree of presence” phenomenon.

6. Dimension 2: Input variants for building DCs
DCs do not exist in firms by mere chance. They are considered as outcomes of deliberate or sometimes emergent organized combinations of several organizational resources and processes. In this section, we discuss about several types of “resources” and “processes” as input variants required for building DCs in firms.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Brief explanation</th>
<th>Authors</th>
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<tbody>
<tr>
<td>Heterogeneity</td>
<td>Degree of variety prevailing among all internal/external capabilities – DCs as well as others – of a firm. This variety results from the uniqueness of each DC</td>
<td>Zollo and Winter, 2002; Helfat and Peteraf, 2003; Pil and Cohen, 2006; Døving and Gooderham, 2008; Adner and Helfat, 2003; Bruni and Verona, 2009; Barreto, 2010</td>
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<tr>
<td>Idiosyncrasy</td>
<td>Degree of path dependency which is difficult to be copied/replicated or repeated/reproduced</td>
<td>Teece et al., 1997; Eisenhardt and Martin, 2000; Pablo et al., 2007; Wang et al., 2015</td>
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<tr>
<td>Predictability</td>
<td>Degree of predictability in creation, sustenance and outcomes of DCs</td>
<td>Eisenhardt and Martin, 2000</td>
</tr>
<tr>
<td>Capability reconfiguration</td>
<td>Degree to which each DC enables transformation into a new capability or evolution to a better capability</td>
<td>Lavie, 2006</td>
</tr>
<tr>
<td>Relative weakness and relative strength among the capabilities</td>
<td>Degree of correlation between the DCs leading to relative strengths or weaknesses, as drivers of competitive advantage of a firm over time</td>
<td>Sirmon, 2010</td>
</tr>
<tr>
<td>VRIN resolution</td>
<td>Degree to which DCs enable recognition, development and classification of organizational resources and processes as valuable, rare, inimitable and non-substitutable</td>
<td>Eisenhardt and Martin, 2000; Ambrosini and Bowman, 2009; Tang et al., 2010; Barreto, 2010; Teece, 2014</td>
</tr>
<tr>
<td>Ability to be evolved and emergence</td>
<td>Degree of evolution of DCs over time, based on several endogenous and exogenous factors exhibiting the lifecycle stages of growth, maturity and decline. During this process, even new DCs could emerge</td>
<td>Rindova and Kotha, 2001; Helfat and Peteraf, 2003; Zott, 2003; Lee, 2008</td>
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<tr>
<td>Hierarchical structure and order/capabilities nesting</td>
<td>Degree of existence of typology and hierarchical linkages between DCs. As the order of the DCs increases, they overcome path dependencies, as these generally lead to imitability of lower-order capabilities</td>
<td>Zott, 2003; Witcher et al., 2008; Døving and Gooderham, 2008; Heimeriks, Schijven and Gates, 2012; Døving and Gooderham, 2008; Wang et al., 2015; Donada et al., 2016; Wollersheim and Heimeriks, 2016; Fainshmidt et al., 2016</td>
</tr>
<tr>
<td>Dynamism</td>
<td>Strength of DCs impacting the creation of competitive advantage in firms</td>
<td>Helfat and Winter, 2011; Schilke, 2014; Wollersheim and Heimeriks, 2016</td>
</tr>
<tr>
<td>Inimitability and non-reproducibility</td>
<td>Degree to which DCs are not imitable or directly usable by other players in the market</td>
<td>Teece et al., 1997; Vergne and Durand, 2011; Teece, 2014; Fainshmidt et al., 2016</td>
</tr>
<tr>
<td>Non-substitutability</td>
<td>Degree to which DCs cannot be substituted by combinations of other capabilities</td>
<td>Zott, 2003; Ambrosini et al., 2009</td>
</tr>
<tr>
<td>Co- and inter-temporal sharability and transferability</td>
<td>Degree to which DCs can be shared concurrently across different markets by a firm and transferred across time, especially when a firm exits a market (often a declining one) and redeploy the capabilities in a new market</td>
<td>Helfat and Peteraf, 2003</td>
</tr>
<tr>
<td>Recombination and fungibility</td>
<td>Degree to which two or more DCs can be recombined to provide an alternate approach to capability renewal in the current product market. This idea of capability recombination draws on the concept of knowledge recombination for structured innovation</td>
<td>Kogut and Zander, 1992; Eggers, 2012; Helfat and Peteraf, 2003; Wang et al., 2015</td>
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Table V.
Characteristics of DCs
6.1 Organizational resources
Organizational resources could be classified into various basic types, namely, human; financial; infrastructure and technological; information, knowledge and organizational systems; and networks and relationships.

6.1.1 Variant 3: human resources. Human resources play a vital part in firms, especially in dynamic environment; adapting new ways toward strategy formulation and execution is a humane activity. According to the recent advances in the emerging field of social cognitive neuroscience, cognition and emotional logic in human resources play a significant role in the process of their strategic adaptation underpinning the capabilities that promote organizational learning, adaptation and performance (Hodgkinson and Healey, 2011). The concept of “managerial cognition” reinforces that human resources not only include physical capabilities, but mental as well, which contributes to the development of cognitive DCs like sensing, seizing and reconfiguring (Helfat and Peteraf, 2015). However, human cognition as a resource for development of DCs should not be restricted to managers alone. As DCs relate to resource exploitation, deployment, acquisition, internalization and dissemination of extant knowledge, resource reconfiguration, divestment, integration and renewal, top executive managerial cognition (Carpenter, Sanders, and Gregersen, 2001), their perceptions and beliefs (Ambrosini and Bowman, 2009) also act as input variants for the formation of DCs in firms. This phenomenon becomes essential when firms build multiple DCs over time, which would likely overlap across their members and the corresponding learning activities involved. Bingham et al. (2015) highlighted the importance of magnitude, timing and similarity of experience among human resources. These accelerate the process of “concurrent learning” in firms. In contrast, a study conducted across 254 Norwegian firms highlighted the importance of diversification of human capital as an input variant for the development of DCs in firms (Døving and Gooderham, 2008). The study argued that human resources configuration in firms should not be static, but subjected to continuous development for promoting heterogeneity of these resources, which, in turn, lays emphasis on training for creativity among the staff members including managers (Azadegan, Bush, and Dooley, 2008). Though many studies restricted human resources to a firm’s staff alone, a few scholars have argued that human resources should include employees, customers and social and cognitive mobilization mechanisms between them. Hence, “human resources” is considered as a superset of variants for development of DCs which include sub-set combinations of human capital, structural capital and relational capital (McKelvie and Davidsson, 2009; Bruni and Verona, 2009). While human capital is grounded on the knowledge created and stored by an organization’s employees, structural capital is defined as the relationships that a firm has with its customers, and relational capital is defined as mobilization of these resources through a prima facie social and cognitive structure (Hsu and Wang, 2012).

6.1.2 Variant 4: financial resources. Financial resources are important as they cut across different parts of the business plan (with financial implications), for example, marketing and sales plan, production plan, personnel plan, capital expenditure, etc. Management scholars have studied investment decisions and financial resource allocation for long. According to Coen and Maritan (2011), financial resources of firms serve as inputs to maintain their existing operational capabilities, as well as for development of new DCs. According to Teece (2007, 2014), financial resources include firms’ investments toward change learning, creation and retention, strategy formulation and implementation. However, unless DCs are measured empirically for returns on investment, keeping up the momentum on these resources could be challenging in the long run. Financial resources are also necessary to meet the costs of coordination of other resources and processes for developing DCs. As noted by Helfat and
Peteraf (2015), a climate for trust may reduce the costs of coordination because organization members tend to utilize heuristics over a more calculative approach when assessing peers in this context.

6.1.3 Variant 5: infrastructure and technological resources. Infrastructure is the foundation or framework that supports a system or organization. Infrastructural resources include traditional infrastructure, such as built spaces, utilities, transportation systems and telecommunications networks, and non-traditional infrastructure, including basic research-related resources. Further infrastructure resources could be commercial, public, social and mixed infrastructure, based on the focus of DCs, and the distribution of productive activities it facilitates (Frischmann, 2012). The project management office as an infrastructural resource has been found to be specifically highlighted in the scholarly literature of DCs. It is important for firms to understand their current levels of existing capabilities before embarking upon the development of new DCs, and technological resources play a vital role in this journey. Technology can be viewed as an activity that forms or changes culture. In the context of building DCs, technology helps to combine other resources to produce desired products, to solve problems, fulfill needs or satisfy wants of the stakeholders. Felin and Powell (2016) suggested the use of design technologies like polyarchy, social proofs and new forms of open organizations that allow firms to build DCs for sustained innovation in dynamic environments. Further, Teece (2007) highlighted the importance of advanced new technologies and analytical systems to learn and to sense, filter, shape and calibrate opportunities for developing DCs.

6.1.4 Variant 6: information, knowledge and organizational systems. Organization systems include a variety of schemes that organize, manage and retrieve information and knowledge. They range from authority files to classification schemes, ontologies, awareness levels, adaptability practices, etc. Firms’ awareness, readiness and adaptability to new technologies play a critical role for the development of DCs. A few scholars also suggested that heuristics could be foundational to DCs in highly dynamic environments where executing common action steps becomes challenging (Bingham et al., 2015; Fainshmidt et al., 2016; Eisenhardt and Martin, 2000; Bingham and Eisenhardt, 2011). Other important resources include core and integrative knowledge existing in both internal and external environments of the firms (Anand et al., 2010). Core knowledge is often scientific or technological specific to a particular vintage or technology which forms the foundation of vertical business units in firms. Integrative knowledge is that which integrates different activities, capabilities and products in one or more vertical units (Helfat and Raubitschek, 2000). Further, Dyer and Nobeoka (2000) highlighted the importance of tacit and explicit knowledge as input variants for DCs building.

6.1.5 Variant 7: networks and relationships. Various terms have been used in literature to describe strategic partnering with equally varied definitions. These include “international coalitions” (Fuller and Porter, 1986), “strategic networks” (Jarillo, 1988) and “strategic alliances” (Schilke, 2014; Eisenhardt and Martin, 2000; Lee et al., 2010; Oh et al., 2014; Kale and Singh, 2007; Capaldo, 2007). Theoretically, an alliance may be the “joining of forces, for a specified or indefinite period, to achieve a common objective”. The communities of personal and professional interactions, both formal and informal, between and within the firms are a central element of such knowledge sharing. However, for the purpose of DCs development, inter-organizational relationships are given more importance than intra-organizational knowledge management. These relationships strengthened by win-win approaches between firms lead to strategic alliances. The positive impact of inter-firm networks on the development of DCs has been traced back to the potential of inter-organizational collaboration to facilitate interactive knowledge sharing processes among...
participating firms (Capaldo, 2007; Dyer and Nobeoka, 2000). This, in turn, is claimed to be strongly dependent on the overall network structure measured in terms of inter-organizational tie strength. Dyer and Nobeoka (2000) highlighted that a few firms like Toyota consciously invest on nested networks to promote inter-organizational learning and provide incentives for knowledge acquisition and application though a formal process. Further to these, the inter-organizational innovation networks (Smart et al., 2007; Lorenzoni and Lipparini, 1999; Gulati, 1999; Wu, 2010) exploit superior resources that reside beyond the boundary of the firm, pose important questions about the nature of resources that exist in the spaces between firms and the capabilities needed to leverage them for competitive advantage to handle the dynamics of complexity in markets. Kleinbaum and Stuart (2014) argued that the investigation of network responsiveness by firms is an important source of DCs, and the network responsiveness rate varies from firm to firm. They also claimed that low network responsiveness may provide coordination advantages via compensatory fit, whereas fast network responsiveness may facilitate more rapid adaptability in firms.

6.2 Organizational processes
We classified various organizational processes which act as input variants for the development of DCs into three key categories, namely, work processes, behavioral processes and change processes.

6.2.1 Variant 8: work processes. According to Teece (2007), opportunity discovery for DCs will be grounded in organizational work processes. Literature shows five important work processes for this purpose. Firstly, exploration, assimilation and exploitation of knowledge becomes critical (Zollo and Winter, 2002; Benner and Tushman, 2003; Benner and Tushman, 2003; Newey and Zahra, 2009; Capaldo, 2007; Capaldo, 2007; Saenz et al., 2014; Dixon et al., 2014). This provides a fundamental input source of understanding the internal and external landscape of the firm. Secondly, the knowledge codification process is recognized as an important learning mechanism from the micro-foundations of DCs (Zollo and Winter, 2002; Kale and Singh, 2007; Macher and Mowery, 2009; Barrales-Molina et al., 2013; Bingham et al., 2015). In contrast, Secchi and Camuffo (2016) argue that knowledge codification enables easier and more precise replication at the cost of oversimplification, and hence should be at optimal levels in the context of building DCs. In parallel, the accumulation process of experiences in firms becomes important in this context, as learning from past mistakes and the pace of experience (referred together as “paths” by Teece (1997) become inputs for building DCs (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). Fourthly, integration of assimilated knowledge though exploration, exploitation and further codification buffered with accumulation of past learnings should be integrated to create a robust resource for competitive advantage (Wang and Ahmed, 2007; Martin, 2011; Essex et al., 2016). Finally, process management becomes an important ingredient, as process management activities are beneficial for organizations to bring about stability and also serve as fundamental input for incremental innovation and change in unstable environments (Benner and Tushman, 2003).

6.2.2 Variant 9: behavioral processes. Behavior is defined as a range of autonomously or externally driven, voluntary or involuntary actions demonstrated by a system (firm). Literature shows eight such behavioral processes in the context of inputs for building DCs. They are:

1. strategic decision-making (Karna et al., 2016);
2. shredding (Teece, 2007);
sensing and shaping (Hodgkinson and Healey, 2011; Martin, 2011; Wilhelm et al., 2015; Fainshmidt and Frazier, 2016; Felin and Powell, 2016);

seizing (Hodgkinson and Healey, 2011; Martin, 2011; Wollersheim and Heimeriks, 2016; Fainshmidt and Frazier, 2016; Felin and Powell, 2016);

reconfiguring (Teece et al., 1997; Karim, 2006; Wang and Ahmed, 2007; Bruni and Verona, 2009; Wu, 2010; Hodgkinson and Healey, 2011; Martin, 2011; Wilhelm et al., 2015; Essex et al., 2016; Wollersheim and Heimeriks, 2016; Fainshmidt and Frazier, 2016; Felin and Powell, 2016);

attacking rivals (Sirmon et al., 2010);

evolutionary learning/co-evolutionary learning; and

isolating mechanisms (Zollo and Winter, 2002; Zott, 2003).

6.2.3 Variant 10: change processes. According to Schreyögg and Kliesch-Eberl (2007), work and behavioral processes alone are not sufficient for building DCs. In the approach to dynamizing capabilities, firms have to look beyond the rigidity trap of operational capabilities, and this is possible by means of effective novel problem-solving patterns for improvement called as “innovation routines”. These innovation routines become a critical input for building DCs, which are defined as a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness’ (Zollo and Winter, 2002). Alongside innovation routines, which lead to incremental innovation in stable environments, transformation for breakthrough innovation also becomes critical, as it leads to new patterns of adapting latest technologies and leveraging them for competitive advantage (Zahra and George, 2002; Lichtenthaler, 2009; Newey and Zahra, 2009; Wang et al., 2015). The importance of bringing new innovation or transformative patterns in firms depends on the quality of change management. The focus of the firms during these change processes is to reduce the intensity of ambiguity that exists between the period of demarcation where a particular thrust ends and another strategic thrust begins. Rindova and Kotha (2001) recommend “continuous morphing” for this purpose. Despite handling the innovation routines and transformation in firms, resistance to change is a well-known management problem that can come from a variety of quarters, including rigid cognitive frames within the organization (Helfat and Peteraf, 2015). As strategic adaptation proceeds, top managers may need to play a role in overcoming organizational resistance to change. Hence, handling resistance to change also becomes another input in building DCs. Another important change process suggested by Karim (2006) deals with improving modularity while exploring changes in organizational structures. He introduced a process called “unit configuration”, which is a systematic addition of units to, deletion of units from and recombination of units within the firm to effect change management in firms.

7. Dimension 3: Influencing factors that impact DCs
This dimension deals with various endogenous (internal to firm), exogenous (external to firm) and inter-related factors (cutting across internal and external environments) which impact DCs in organizations.

7.1 Endogenous factors
These include organizational culture, leadership, firm-specific factors and managerial actions which impact DCs with various intensities in firms.
7.1.1 Variant 11: organization culture. Erstwhile management thinkers defined the term “organizational inertia” as the capacity to produce collective outcomes of a certain quality repeatedly, and they emphasized this as a requirement for guaranteed survival (Hannan and Freeman, 1984). However, contemporary thinkers have argued that organizational inertia does not help firms change inhibiting organizational cultures (Schreyögg and Kliesch-Eberl, 2007). This is because, if firms are bound to their stabilized structures and action patterns, it may lead to the risk of maladaptation. We endorse this claim considering organizational inertia as an influencing factor on DCs. Further, organizational cultural intelligence also plays a key role on DCs (Moon, 2010). Another influencing factor is the firm’s age and accumulated experience/evolution paths. There is abundant literature affirming that a firm’s age, paths it traveled and the lessons learned through accumulated experiences bring in varying degrees of maturity in it in regards the way it handles DCs (Mosey, 2005; Zahra et al., 2006; Kotha et al., 2011; Eggers, 2012; Chen et al., 2012; Barrales-Molina et al., 2013; Schilke, 2014; Essex et al., 2016; Fainshmidt and Frazier, 2016). Further, Eggers (2012) claimed that DCs were also impacted by the size of the firms. Though “firm size” is a relative term and depends on the sizes of other firms in the marketplace, apparently, it is an influencing factor on DCs (Døving and Gooderham, 2008; McKelvie and Davidsson, 2009; Wu, 2010; Jiang et al., 2010; Fawcett et al., 2011; Fainshmidt and Frazier, 2016). As DCs rely on collective learning and coordinated effort by organization members, a firm’s social climate, which shapes patterns in attitudes, behaviors and interpersonal relationships among organizational members, may be a driver of DCs (Fainshmidt and Frazier, 2016). Further, an organization’s form (monarchy/polyarchy) impacts its DCs, as scholars claimed that performance of DCs was observed to be better in polyarchical structures (Teece, 2007; Felin and Powell, 2016). The empowerment level of staff, freedom to question status-quo and risk taking ability which are together defined under the term “autonomy” in the DCs literature, are important factors which impact the DCs (Martin, 2011; Secchi and Camuffo, 2016; Felin and Powell, 2016).

7.1.2 Variant 12: leadership. Organizational leaders, especially in the top-management positions, play a critical role in decision-making, strategy planning, formulation and implementation. Leadership being an art, which varies from person to person (and context to context) based on several other factors, serves as an impacting variant on DCs. The reviewed literature shows that several leadership elements such as selection of product architecture and business models (Teece, 2007), entrepreneurial mindset (Savolainen, 1999; Teece, 2007), DCs configuration and orchestration (Kor and Mesko, 2013; Sirmon and Hitt, 2009), strategy formulation, planning and budgeting, setting direction, environmental scanning (Davenport, 1993; Rosenbloom, 2000; Bititci et al., 2011), handling success traps (Wang et al., 2015) have impacted DCs in organizations.

7.1.3 Variant 13: firm-specific factors. Literature shows several firm-specific factors which impact DCs. These include idiosyncratic structures (Eisenhardt and Martin, 2000; Schreyögg and Kliesch-Eberl, 2007; Vergne and Durand, 2011), product/service diversification (Eggers, 2012), path dependency and prior performance (Arthur, 1989; Cowan and Gunby, 1996; Schreyögg and Kliesch-Eberl, 2007; Vergne and Durand, 2011; Pentland et al., 2012; Eggers, 2012; Girod, and Whittington, 2017), timing of deployment of the DC (Zott, 2003; Eggers, 2012), cost of deploying DCs (Zott, 2003; Eggers, 2012), architectural innovation degree (Galunic and Eisenhardt, 2001), ambidexterity in structures (Benner and Tushman, 2003; Teece, 2014; Kleinsbaum and Stuart, 2014; Secchi and Camuffo, 2016), market intelligence (Mosey, 2005; Morgan et al., 2009) and market strategic orientation (Morgan et al., 2009; Zhou and Li, 2010).
7.1.4 Variant 14: managerial actions. There are several reasons why managerial actions become an essential factor impacting DCs (Martin, 2011). Firstly, managers are tasked with developing the capabilities necessary to formulate and implement their business unit-level strategies to accomplish firm-level strategic objectives. Secondly, managers have power and control over their business units with a responsibility toward business delivery. Finally, managers have an obligation to effectively work with organizational resources and processes. To endorse these arguments, we have identified several managerial actions which scholars have highlighted as having a significant impact on DCs in firms. They are problem-solving and handling complexity (Schreyögg and Kliesch-Eberl, 2007; Macher and Mowery, 2009; Fainshmidt et al., 2016), market communications (Eggers, 2012), managerial dominant logic (Kor and Mesko, 2013), performance measurement and reporting, resource allocation, staff management, infrastructure building, stakeholder communications (Davenport, 1993), managing strategy, managing performance, resource planning and allocation, alliancing and networking, managing change, strategic decision-making, competence building, organizational learning, knowledge management (Bititci et al., 2011) and managerial cognition (Kor and Mesko, 2013). Alongside these managerial actions, capability monitoring and non-routine dynamization (Schreyögg and Kliesch-Eberl, 2007) are considered as critical, as these have a direct impact on improving and renewing DCs. Further, scholars also highlighted the importance of “concurrent learning” (Helfat and Peteraf, 2003; Bingham et al., 2015), which enables managers to learn multiple DCs concurrently.

7.2 Exogenous factors
These include variants like competitors, suppliers and customers, market influence and social, economic, regulatory and legal factors impacting DCs from the external environment of firms.

7.2.1 Variant 15: competitors. Rivalry in the marketplace extending to higher levels leads to hyper-competition which undermines the sustainability of a competitive advantage (Lee at al., 2010; Barreto, 2010), and is hence considered to have an impact on DCs (Sirmon et al., 2010). Rindova and Kotha (2001) suggested that “continuous morphing” on the DCs of the firm leads to continuous change to regenerate a competitive advantage in hyper-competitive environments. Further, firms’ understanding about their rivals’ capabilities and the changes in competitive landscape impact the levels of DCs. In fact, it is essential for firms to revise or renew DCs based on these factors (Sirmon et al., 2010; Lee, 2010). Among several strategies rivals impose on firms, imitation potential of rivals retards the progress of DCs (Zott, 2003). This is common among new entrants, and hence, competitive parity becomes essential (Ambrosini and Bowman, 2009; Dixon et al., 2014). Further, literature also shows evidence of systems-based competition (Lee et al., 2010) and randomness in competition (Zott, 2003) that impact DCs in firms.

7.2.2 Variant 16: suppliers and customers. An understanding of an enterprise is beyond the boundaries of the organization, which includes both suppliers and customers. Karna et al. (2016) categorized supplier and customer relationships with firms as operational capabilities. However, customer management capability, customer management performance, supply chain management performance, integrated closely with raw materials suppliers, customerside online information capabilities and supplier-side online information capabilities are fundamental to supply chain management and customer relationship management. Hence, any changes in these variants would impact the relevant DCs. Further, Zollo and Winter (2002) highlighted that environmental conditions such as the speed of technological
development or the time-to-market lags required by customers consequently influence DCs in firms.

7.2.3 Variant 17: market influence. The most important parameter in this category is the market type (Marcus and Anderson, 2006; Lee, 2008; Barreto, 2010). This is because DCs operate differently based on market velocity. Teece et al. (1997) highlighted that DCs operate when markets are moderately dynamic, but in high-velocity markets, where the strategic imperatives are speed and adaptability, DCs take on a different character (Peteraf et al., 2013). Literature also shows some criticisms in this regard, that sustaining DCs in high-velocity markets is difficult unless firms do not consciously safeguard them (Eisenhardt and Martin, 2000). Another factor is “environmental dynamism”, which refers to rate at which the preferences of consumers and the products/services of organizations change over time. This phenomenon, in combination with market dynamism, hostility among the market players and heterogeneity within and between the markets, contribute to carrying impacts on DCs (Zahra et al., 2006; Ambrosini et al., 2009; Zhou and Li, 2010; Drnevich and Kriauciunas, 2011; Martin, 2011; Barrales-Molina et al., 2013; Stadler et al., 2013; Schilke, 2014; Schilke, 2014; Weber and Tarba, 2014; Wilhelm et al., 2015; Karna et al., 2016; Wang et al., 2015; Li et al., 2015; Girod, and Whittington, 2017; Fainshmidt et al., 2016; Gerhard et al., 2016). Further, technological dynamism and how quickly firms adapt to the same ahead of the other market players is also a key factor. A rival’s capability to cannibalize valuable assets and productive activities impact a firm’s marketing and technological DCs (Fainshmidt et al., 2016). Further, industry effects (Schilke, 2014), task environment (Karna et al., 2016), environmental munificence (Danneels, 2008; Sirmon et al., 2010), uncertainty and complexity in markets (Aragon-Correa and Sharma, 2003; Schreyögg and Kliesch-Eberl, 2007; Ambrosini and Bowman, 2009; Wu, 2010; Dixon et al., 2014; Felin and Powell, 2016; Essex et al., 2016), market turbulence and technological turbulence (Slater et al., 2006; Lichtenthaler, 2009; Dixon et al., 2014) and market demand (Martin, 2011) are some other factors which impact various DCs.

7.2.4 Variant 18: social, economic, regulatory and legal factors. Globalization has paved the way for utilization of technology across nations, where achieving protection against imitation and other forms of replication by rivals becomes challenging. Hence, for shaping new “rules of the game” in the global marketplace, global executives need to be mindful of the impact of globalization on their DCs (Teece, 2000; 2007). Further, increased diversity in partners’ industry, organizational and national background will cause added complexity and coordination costs for firms, but provide broadened resource and learning benefits (Ambrosini and Bowman, 2009; Jiang et al., 2010). As ideas flow from all sides in multi-cultural firms, promoting national and industry diversity results in innovation. Alongside national factors, political and regulatory influences in various countries not only impact the local players, but also influence the competitive advantage of global firms (Malik and Kotabe, 2009; Dixon et al., 2014). Hence, Galunic and Eisenhardt (2001) suggested envisaging DCs as areas of responsibility that could be recombined in various ways as per the interplay of economic and social imperatives as a “dynamic community”. Further, literature shows that social capital (Blyler and Coff, 2003; Bruni and Verona, 2009) and social responsiveness (Sodhi, 2015) impact DCs in firms.

7.3 Inter-related factors
These factors could impact the DCs either from external or internal environments based on the context, and hence, they are inter-related with regard to the environmental and firm-level boundaries.
7.3.1 Variant 19: Inter-related factors. Various inter-related factors that were found to impact the DCs are presented in Table VI.

8. Dimension 4: desired outcomes of DCs

Required outcomes bundled with appropriate experiences result in the desired outcomes. There are several firms’ desired outcomes that result from the DCs, which are identified from the literature and grouped as short- and long-term outcomes.

8.1 Short-term outcomes

These include variants like creation of competitive advantage, performance and profits and value creation in firms.

8.1.1 Variant 20: short-term competitive advantage. Sirmon et al. (2010), after discussing the strengths and weaknesses of operational capabilities, highlighted that DCs could deliver temporary competitive advantage to firms. Evidence suggests that achieving sustained competitive advantage requires managers to understand the bases of competitive advantage as a concatenation of a series of temporary advantages over time (Powell, 2001; Sirmon et al., 2010; Dixon et al., 2014). Further, DCs also help firms in strategic renewal processes, which are central to creation of advanced products and services in the marketplace consistently as per evolving customer needs (Eggers, 2012). Other short-term outcomes of DCs include promoting innovation in the firms which leads to incremental innovative performance (Benner and Tushman, 2003; Mosey, 2005; Capaldo, 2007) and subsequent innovative output (Kotha et al., 2011).

8.1.2 Variant 21: performance and profits. There are several performance and profit-related outcomes which DCs deliver. Literature shows that DCs have benefited firms by improving stock market returns (Bingham et al., 2015), differential firm performance (Zott, 2003), higher operational effectiveness and efficiency (Teece et al., 1997; Tang Liou 2010; Saenz et al., 2014; Vanpoucke et al., 2014; Secchi and Camuffo, 2016), static and dynamic efficiency (Ghemawat and Ricart-Costa, 1993), functional and adaptive efficiency (Wilhelm et al., 2015), gross revenue and gross profit (Døving and Gooderham, 2008; Essex et al., 2016), return on assets (Adner and Helfat, 2003; Morgan et al., 2009; Hsu and Wang, 2012; Girod and Whittington, 2017) and returns on investments (Zollo and Winter, 2002).

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<th>Inter-related factor</th>
<th>Authors</th>
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<tr>
<td>Best practices</td>
<td>Eisenhardt and Martin, 2000; Teece, 2007; Teece, 2014; Wang et al., 2015</td>
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<td>Path-dependency lock-ins</td>
<td>Schreyogg and Kliesch-Eberl, 2007; Vergne and Durand, 2011</td>
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<td>Firm’s entry mode and timing</td>
<td>Lee, 2008; McKelvie and Davidsson, 2009; Anand et al., 2010</td>
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<tr>
<td>Strategic liabilities</td>
<td>Dyer and, 2000; Sirmon et al., 2010; Tang and Liou, 2010</td>
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<td>Firm’s weakness set and strength set</td>
<td>(Sirmon et al., 2010)</td>
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<td>Precarious advantage</td>
<td>Sirmon et al., 2010</td>
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<td>Entry strategies (first entry advantage)</td>
<td>Rosenbloom, 2000; Zott, 2003; McKelvie and Davidsson, 2009; Eggers, 2012</td>
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<tr>
<td>Resource alteration (leveraging existing resources, creating new resources, assessing external resources, releasing resources)</td>
<td>Danneels, 2011; Kor and Mesko, 2013</td>
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Table VI. Inter-related factors impacting DCs
8.1.3 Variant 22: value creation. “Value” has been defined by many scholars in many ways. However, the community of scholars studying DCs has defined value to firms as a contribution through six value creating attributes. Firstly, value is defined by the outcome of DCs to organizational learning and unlearning process (Zahra et al., 2006; Macher and Mowery, 2009; Malik and Kotabe, 2009; Wu, 2010; Hanson et al., 2011; Barrales-Molina et al., 2013; Cepeda-Carrion et al., 2012; Dixon et al., 2014). This is a primary value attribute as the body of knowledge of dynamization is based on the fundamental concept of learning and unlearning in firms as per the changes in the environment to create and sustain competitive advantage. Post unlearning the old patterns and learning the new ways, organizational alignment to the newly adapted technologies becomes essential, and this is challenging considering organizations as complex systems with several resources, processes and impacting factors (Stadler et al., 2013). DCs help organizations in achieving the organizational alignment (Hanson et al., 2011; Essex et al., 2016). Further DCs also improve agility and flexibility to facilitate this process (Chiang et al., 2012). Even though firms learn and unlearn periodically using DCs and align themselves with agility and flexibility, the existing operational capabilities in the firms operate on a relative basis with the DCs, as they cannot be separated altogether from the capability framework of the firm. Hence, relative capability creation in firms, which is the rate of sustaining the existing operational capabilities in par with building DCs, becomes essential. There is evidence in the literature that DCs could contribute to relational capability creation (Donada et al., 2016) with a focus on other desired outcomes, including customer satisfaction (Moon, 2010; Fawcett et al., 2011).

8.2 Long-term outcomes
These include variants like creation of long-term competitive advantage, market share and value sustenance in firms.

8.2.1 Variant 23: long-term competitive advantage. Sirmon and Hitt, (2009) claimed that creating competitive advantage should be a milestone, and not the end of strategic aspirations of firms. The durability of competitive advantage needs to be gauged, as it leads to sustenance, and this is generally limited to the relative strength and weakness sets of firms which change significantly over time in rivalrous markets. Tang and Liou. (2010) highlighted that DCs could certainly help firms in creating sustained competitive advantage because of their unique characteristics. This could be achieved through several other interlinked outcomes that DCs deliver like promoting concurrent learning (Bingham et al., 2015), business and social competency development (Marcus and Anderson, 2006), breakthrough innovation or radical change (Mosey, 2005; Hanson et al., 2011; Helfat, and Winter, 2011), innovation performance or innovativeness quotient in firms (Zahra and George, 2002; Cepeda-Carrion et al., 2012) etc.

8.2.2 Variant 24: market share. There is evidence in the literature that DCs lead to improved market share. In rivalrous markets, it is the relative (to competitors) capability instead of an absolute quality of capabilities that matters most for competitive advantage (Sirmon et al., 2010). On these lines, Drnevich and Kriauciunas (2011) introduced the term “relative firm performance” as a relative coordinate of firm-level performance with regard to the firm’s industry or marketplace. They concluded their research clarifying that DCs contributes positively to a firm’s relative performance. Further, scholars have endorsed the fact that DCs could improve the overall competitive position of firms in the markets (Vanpoucke et al., 2014; Essex et al., 2016).

8.2.3 Variant 25: value sustenance. Value creation being perhaps regarded as a short-term outcome of DCs, sustaining the created value in firms is the long-term outcome. This is
because value creation is not a one-time activity, but should be a part of organizational culture to create sustained competitive advantage. DCs facilitate the process of sustaining value outcomes in firms by nourishing the overall efficiency (Bingham et al., 2015), creating patterns of flexibility (Scherrer-Rathje et al., 2014; Bingham et al., 2015), promoting sustainable superior performance (Easterby-Smith and Prieto, 2008; Tang and Liou, 2010), sustained profitable growth (Teece, 2007; Girod and Whittington, 2017) and finally, by creating a culture of information sharing within the firm (Fawcett et al., 2011).

9. Dimension 5: assessment yardsticks for DCs
Building DCs through input variants and nourishing or protecting DCs from the negatively impacting factors are mammoth tasks that require formal, well-planned and executed and monitored approaches for realizing the desired outcomes. The entire process will be futile unless there is a mechanism to assess the magnitude of success of the DCs in firms. Hence, measures of DCs form an important variant in the MA framework.

9.1 Variant 26: measures/key metrics of DCs
The various measures of performance and success of DCs in firms have been identified from the literature and are presented in Table VII.

The MA framework comprising the five dimensions discussed above, along with their respective variants and several attributes defined under each variant is presented in Figure 2. The framework provides a structure to represent the overall literature of DCs corresponding to papers published in selected top-tier journals during the period since 1990 to 2016. By showing the possible conceptual relationships between and among concepts hitherto considered to be disconnected, it eliminates or at least minimizes the vagueness in the DCs approach reported by a few scholars. Further, it enables development of an integrated understanding of the body of knowledge concerning DCs by virtue of the MA frameworks' roots being in the wider field of systems thinking.

10. Implications and directions for future research
Motivated by the growing influence, importance and criticism of DCs among contemporary management thinkers in the modern business world, our paper has examined the different theoretical and research perspectives in the selected literature. These works have contributed to our understanding of the DCs approach as a strategic management concept used to derive several benefits and advantages to firms, including the development of competitive advantage. Through this paper, we have clarified several important propositions of the theory of DCs. Firstly, we defined characteristics of DCs and collated 81 DCs identified separately by various scholars. This lays the foundation for researchers in this field to test whether several other similar management constructs exhibit the characteristics of DCs, in organizational contexts. Further, future research agenda could include investigating the linkages, or inter-relationships, among these individual DCs.

Secondly, we have countered the existing myth in the research community that the DCs approach is tautological without practical implications. A comprehensive review of research literature clarifies that 71 per cent of the selected research papers studied here have used empirical methods. The many case studies that have been published have established strongly the practical value of the DCs approach. Though we have proposed assessment yardsticks though this paper, there is significant potential to build in more objectivity on this subject. Future empirical research could strengthen this claim.
Thirdly, we noted that literature on the subject has been vaguely organized and spread across various directions of exploration, with emphasis on isolated concepts of the DCs approach, and on individual DCs. Through this paper, we contribute to the theory of the DCs approach by proposing a much-needed structure to the loosely packed literature. Most previous research has rested on foundations of isolated associated topics with separate

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<tr>
<th>Measures of DCs</th>
<th>Brief explanation</th>
<th>Authors</th>
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<tr>
<td>Capability rarity</td>
<td>Level of effectiveness per capability as opposed to its mere existence</td>
<td>Sirmon et al., 2010</td>
</tr>
<tr>
<td>Structural change ratio</td>
<td>Ratio of restricting changes above the expected threshold in senior management</td>
<td>Girod and Whittington, 2016</td>
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<tr>
<td>Dynamism measure</td>
<td>Rate of change of firm’s sales to annual industry sales</td>
<td>Girod and Whittington, 2016</td>
</tr>
<tr>
<td>Degree of causal clarity</td>
<td>Degree of clarity in a DC with regard to the causal relationships between the decisions or actions taken and the performance outcomes obtained</td>
<td>Zollo and Winter, 2002; Blyer and Coff, 2003</td>
</tr>
<tr>
<td>Degree of independence and degree of simultaneity</td>
<td>Degree to which DCs contribute effectively while being independent or supporting other existing capabilities, tasks and processes simultaneously</td>
<td>Zollo and Winter, 2002</td>
</tr>
<tr>
<td>Technical fitness</td>
<td>Degree to which a DC performs its intended function, regardless of how well other capabilities enable a firm to make a living</td>
<td>Teece, 2007; Helfat et al., 2007; Bingham et al., 2015; Martin, 2011</td>
</tr>
<tr>
<td>Evolutionary fitness</td>
<td>Degree to which a DC enables evolutionary changes within the firm, with reference to environmental changes</td>
<td>Teece, 2007; Helfat et al., 2007; Bingham et al., 2015; Kor and Mesko, 2013; Martin, 2011; Newey and Zahra, 2009; Teece, 2014</td>
</tr>
<tr>
<td>Strategic fitness</td>
<td>Degree of managing the resource bundles that cannot be comprehended or imitated by outsiders</td>
<td>Tang et al., 2010</td>
</tr>
<tr>
<td>Strategic flexibility</td>
<td>Degree of a DCs to quickly commit resources to new courses of action in response to environmental changes and recognize and act promptly when it is time to halt or reverse existing resource or process commitments</td>
<td>Zahra and George, 2002; Shimizu and Hitt, 2004; Barrales-Molina et al., 2013; Helfat et al., 2007</td>
</tr>
<tr>
<td>Structural flexibility/agility</td>
<td>The ability of DCs to facilitate firms to adapt the current organizational structure to newly changed conditions</td>
<td>Barrales-Molina et al., 2013; Weber and Tarba, 2014</td>
</tr>
<tr>
<td>Operational flexibility/agility</td>
<td>The ability of DCs to renew operational capabilities (most day-to-day tasks or routines involved in basic processes)</td>
<td>Zollo and Winter, 2002; Teece, 2007; Barrales-Molina et al., 2013</td>
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Table VII. Assessment yardsticks for DCs
Figure 2 Conceptual framework

**Pre-requisites/Assumptions**

- Existence of Ordinal Operational capabilities (Dvirvich & Kriozusz, 2011; Karna et al., 2015; Helfat and Peteraf, 2003; Helfat and Winter, 2011; Eisenhardt and Martin, 2000; Wang et al., 2015; Piller et al., 2007)
- Markets operate in Schumpeterian world (Teece, 1997; Peteraf, 2003)
- Modularity exists in firm's systems (Piller and Cohon, 2006)
- Resources availability in firms (Helfat and Peteraf, 2003)
- Fundamental units of analysis of firms: Processes, positions, paths (Teece et al., 1997)

**Characterization of DCs**

- Heterogeneity: (Helfat and Peteraf, 2003; Piller and Cohon, 2006; Dovin and Goodrum, 2008; Aderer and Helfat, 2003; Zollo and Winter, 2002; Barretta, 2010; Brui and Verona, 2009; Dvirvich and Kriozusz, 2011)
- Idiosyncrasy: (Teece et al., 1997; Eisenhardt and Martin, 2000; Wang et al., 2015; Piller et al., 2007)
- Predictability: (Eisenhardt and Martin, 2000)
- Capability Reconfiguration: (Larivé, 2006)
- Relative weakness and relative strength among the capabilities (Simon, 1973)
- VRIN: valuable, rare, inimitable and non-substitutable (Eisenhardt and Martin, 2000; Tung et al., 2010; Barretta, 2010; Teece, 2014; Ambrosini and Bowman, 2009)
- Evolvability and Emergence: (Helfat and Peteraf, 2003; Rindova and Kohba, 2001; Lee, 2008; Zott, 2003)
- Hierarchies: Order of capabilities & Capabilities nesting: (Zott, 2003; Heimeriks, Schijven and Gates, 2012; Wicher, Sun Chin, and Huang, 2009; Dovin and Goodrum, 2008; Danneels, 2008; Dovin et al., 2016; Wolferborn and Heimeriks, 2016; Wang et al., 2015; Fainshmidt et al., 2016)
- Level/Degree of Dynamics: (Schiklo, 2014; Helfat, and Winter, 2011; Wolferborn and Heimeriks, 2016)
- Instability and non-repeatability: (Teece et al., 1997; Verspy and Dumol, 2011; Fainshmidt et al., 2016; Teece, 2014)
- Non-Subsustainability: (Zott, 2003; Ambrosini et al., 2009)
- Shareability and inter-firm transferability: (Helfat and Peteraf, 2003)
- Reconfiguration and fragility: (Kogut and Zander, 1992; Helfat and Peteraf, 2003; Eggers, 2012; Wang et al., 2015)

<table>
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<tr>
<th>Resources</th>
<th>Processes</th>
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<tr>
<td>Human Resources</td>
<td>Financial Resources</td>
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<tr>
<td>• Managerial cognition and emotion: (Helfat and Peteraf, 2015; Hodgkinson and Healey, 2011)</td>
<td>• Strategic investments: (Teece, 2007; Teece, 2004; Coen and Mansfield, 2011)</td>
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<tr>
<td>• Magnitude, timing, and similarity of experience: (Bingham et al., 2015)</td>
<td>• Cost of coordination: (Helfat and Peteraf, 2015)</td>
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<tr>
<td>• Diversification of intangible resources: (Dovin and Goodrum, 2008)</td>
<td>• Intellectual Capital: (McKelvie and Davidson, 2009; Hu and Wang, 2012; Brui and Verona, 2009)</td>
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<tr>
<td>• Top Executive’s managerial experience: (McKelvie and Davidson, 2009; Hu and Wang, 2012)</td>
<td>• Top Management's Beliefs: (Ambrosini and Bowman, 2009)</td>
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<tr>
<td>• Top Management’s Beliefs: (Ambrosini and Bowman, 2009)</td>
<td>• Training for creativity: (Azadegan, Bosh, and Doore, 2008)</td>
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## Figure 2

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<tr>
<th>Endogenous Factors</th>
<th>Exogenous Factors</th>
<th>Interrelated Factors</th>
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<td>Organization Culture</td>
<td>Leadership</td>
<td>Other firm-specific factors</td>
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<tr>
<td>Structural inertia (Schnyde and Klocke, 2007)</td>
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<tr>
<td>Firm’s age and accumulated experience/evolution path (Schiitte, 2014; Monev, 2005; Eggers, 2012; Chen et al., 2012; Enex et al., 2016; Faisenhof and Frazer, 2016; Barach-Golina et al., 2012; Zahra et al., 2006; Moon et al., 2006)</td>
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<tr>
<td>Firm’s size (Eggers, 2012; Doving and Goodrum, 2008; Jiang, 2010; Fawcett et al., 2011; Faisenhof and Frazer, 2016; McKibbin and Davidson, 2009; Wu, 2010)</td>
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<tr>
<td>Organisational Climate (Faisenhof and Frazer, 2016)</td>
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<td>Decentralized organisation/polyarchy (Eggers, 2007; Fein and Powell, 2016)</td>
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<td>Antinomy (Scicchitano and Carlucci, 2016; Martin, 2011; Fein and Powell, 2016)</td>
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<td>Organisational Cultural Intelligence (Moon, 2010)</td>
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<td>Selection of product architecture and business models (Teo, 2007)</td>
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<tr>
<td>Entrepreneurial mind-set (Teo, 2007; Saolabancen, 1999)</td>
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<td>SO configuration and orchestration (Kor and Mecko, 2013; Simons and Hitt, 2009)</td>
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<td>Strategy formulation, planning and budgeting, setting direction, Environmental scanning (Davenport, 1993; Bittel et al., 2011; Ruczbloum, 2000)</td>
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<td>Success traps (Wang et al., 2015)</td>
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<td>Idiosyncratic structure (Schnyde and Klocke, 2007; Eisenhardt and Martin, 2000; Venugop and Durrand, 2011)</td>
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<td>Product/service diversification (Eggers, 2012)</td>
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<td>Path dependency and Prior Performance (Schnyde and Klocke, 2007; Arthur, 1989; Covin and Gorbat, 1996; Eggers, 2012; Girid, and Whittington, 2016; Verweij and Durand, 2011; Powidula et al., 2012)</td>
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<td>Timing of deployment of dynamic capabilities (Zott, 2003; Eggers, 2012)</td>
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<td>Architectural innovation (Galor and Eisenherz, 2001)</td>
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<td>Ambidexterity in structures (Boumer and Tushman, 2003; Sciclun and Camuffo, 2016; Teo, 2014; Kirschbaum and Sturt, 2014)</td>
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<td>Market intelligence (Monev, 2005; Morgen et al., 2009)</td>
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<td>Market strategic orientation (Morgen et al., 2009; Zhou and Li, 2010)</td>
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<tr>
<td>Problem solving and Handing complexity (Schnyde and Klocke, 2007; Macher and Movory, 2009; Faisenhof et al., 2016)</td>
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<tr>
<td>Capability Monitoring and Non routine dynamization (Schnyde and Klocke, 2007)</td>
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<td>Concurrent learning (Bingham et al., 2015; Hoffst and Peters, 2003)</td>
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<td>Communications (Eggers, 2012)</td>
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<td>Managerial Dominant Logic (Kor and Mecko, 2013)</td>
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<td>Performance measurement, and reporting, Resource allocation, Human resource management, Infrastructure building, Stakeholder communication (Davenport, 1993)</td>
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<td>Managing strategy, managing performance, Resource planning and allocation, Alliances and networking, managing change, Strategic decision making, Communication, Competence building, Organisational learning, Knowledge management (Bittel et al., 2011)</td>
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<td>Imitation potential from rivals (Part, 2003)</td>
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<td>Hypo-competitio- (Simons et al., 2010; Lee et al., 2010; Rinot and Kotba, 2001; Baeve, 2010)</td>
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<td>Rivals’ capabilities (Simons et al., 2010)</td>
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<td>Competitive landscape (Simons et al., 2010; Lee, 2010)</td>
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<td>Time-to-market requirements by customers (Zollo and Winter, 2002)</td>
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<td>Market influence (Teo, 2000; Teo, 2007)</td>
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<td>Dynamic Community (Galor and Eisenherz, 2001)</td>
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<td>Social responsiveness (Sodhi, 2013)</td>
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<td>Social Capital (Blakker and Cuff, 2003; Straus and Vosema, 2009)</td>
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<td>National and industry diversity (Yang, 2010; Ambrosini and Bowman, 2009)</td>
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<td>Resource abundant (Barach-Golina et al., 2012; Barach-Golina et al., 2013; Li and Hoplinger, 2015; Schiitte, 2014; Gled and Whittington, 2016; Stadler et al., 2013; Martin 2011; Burtaler-Mollena et al., 2012; Ambrosini et al., 2009; Wang et al., 2015; Faisenhoff et al., 2016; Zahra et al., 2006; Weber and Tarha, 2014; Zhou and Li, 2010; Zaril and Ottman, 2014; Gobard et al., 2016; Wilkie et al., 2015)</td>
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<td>Technological dynamism (Faisenhoff et al., 2016)</td>
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<td>Industry effects (Schiitte, 2014)</td>
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<td>Environmental dynamism (Ko et al., 2013; Lee, 2008; Baratz, 2010; Murau and Anderson, 2005)</td>
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<td>Environmental uncertainty (Simons et al., 2010; Danneels, 2008)</td>
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<td>Volatility, Uncertainty, Complexity and Multifunctionality (Aregin-Laure and Sharma, 2003; Ambrosini and Bowman, 2009; Wu, 2010)</td>
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<td>Resource orientation (Barach-Golina et al., 2007; Enex et al., 2016; Dixon et al., 2014; Fein and Powell, 2014)</td>
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<td>Market turbulence and technological turbulence (Lichtenthaler, 2009; Stayer et al., 2006; Dixon et al., 2014)</td>
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<td>Market Durand (Martin 2011)</td>
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<td>Best Practice (Eisenhardt and Martin, 2000; Teo, 2007; Wang et al., 2015; Teo, 2014)</td>
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<td>Path-dependency lock-ins (Schnyde and Klocke, 2007; Verweij and Durand, 2011)</td>
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<td>Firm’s Entry mode and timing (Lee, 2008; Assad et al., 2016; McKitric and Davidson, 2009)</td>
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<td>Strategic Liabilities (Simons et al., 2010; Tang and Lien, 2010; Dyer and Ron, 2009)</td>
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<td>Firm’s weaknesses and strength-soft (Simons et al., 2010)</td>
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<td>Pecuniary advantages (Simons et al., 2010)</td>
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<td>Entry Strategies - First cost advantage (Zott, 2003; Eggers, 2012; Ruczbloum, 2006; McKitric and Davidson, 2009)</td>
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<td>Resource alteration (lending existing resources, creating new resources, accessing external resources, releasing resources) (Danneels, 2011; Kor and Mecko, 2013)</td>
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<td>Desired Outcomes</td>
<td>Competitive Advantage</td>
<td>Performance and Profits</td>
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<td>Short-term</td>
<td>Temporary competitive advantage: (Simon et al., 2010; Dixon et al., 2014)</td>
<td>Stock market returns (Bingham et al., 2015)</td>
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<td></td>
<td>Strategic renewal (Uggen, 2012)</td>
<td>Differential Firm performance (Zott, 2003)</td>
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<td></td>
<td>Incremental Innovative performance (Broun and Tushman, 2005; Merrile, 2005; Capaldo, 2010)</td>
<td>Operational Effectiveness and efficiency (Scehe and Camfeld, 2016; Zhao et al., 2010)</td>
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<td></td>
<td>Quantity of Innovative output (Kotha et al., 2011)</td>
<td>Functional and Adaptive efficiency (Wilhelm et al., 2015)</td>
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<td>Gross revenue and gross profit (Davies and Goodchild, 2009; Erics et al., 2016)</td>
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<td>Return on Assets (Morgan et al., 2009; Giod, and Whittington, 2016; Hoer and Helfat, 2003; Hsu and Wang, 2012)</td>
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<td>ROA on Investments (Zollo and Winter, 2002)</td>
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### Measures/Key Metrics

- Capability Rarity: (Simon et al., 2010)
- Structural change ratio (Giod, and Whittington, 2016)
- Dynamism measure/degree of causal ambiguity (Giod, and Whittington, 2016)
- Degree of independence/degree of similarity (Zollo and Winter, 2002)
- Technical Fitness: (Toce, 2007; Helfat et al., 2007; Bingham et al., 2015, Martin 2011)
- Evolutionary Fitness: (Toce, 2007; Helfat et al., 2007; Bingham et al., 2015, Kor and Mesto, 2015, Martin 2011; Nencsy and Zahra, 2009; Toce, 2014)
- Strategic Fitness: (Tang et al., 2010; Strategic Flexibility: (Zahra and George, 2002; Burrell-Melina et al., 2012; Helfat et al., 2007; Singleton and Hitt, 2004)
- Strategic, Structural and Operational Flexibility/Agility: (Burrell-Melina et al., 2012; Weber and Taiba, 2014)

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**Figure 2.**
theories and conceptual models, including empirical studies based on surveys and experiments.

In this paper, we have examined and integrated multiple theoretical perspectives on DCs; this is not evident in the literature thus far. The MA framework proposed in our paper is the first attempt to develop a holistic conceptual representation of various theories pertaining to DCs. It minimizes or even eliminates the vagueness in those theories reported by a few authors (Kraatz and Zajac, 2001; Davis, 2004; Newbert, 2007; Arend and Bromiley, 2009) and can be used to resolve the differences in the key assumptions and levels of analysis across them. The MA framework can also be used as a reference to identify and examine possible gaps in the literature and then work on research opportunities. The MA framework has five dimensions having a total of 26 variants. Keeping in mind the selected literature based on which the framework has been proposed here, we acknowledge that some new dimensions and variants (across the building blocks, input variants, impacting factors, desired outcomes and assessment yardsticks) can be identified and integrated into it and enrich it on a continuing basis.

Practical implications of this study include directions to managers to see DCs as an “integrated whole” rather than “fragmented many” in real-world situations. Secondly, the MA framework devised as part of this paper could help in deducing various relevant dimensions and appropriate variants in the context of DCs. Thirdly, a systems thinking perspective of DCs presented here would be valuable for the leadership decision-making process. Finally, the yardsticks for measuring DCs featured as part of this study would lead to DCs maturity measurement in firms.

We observe that there is either a significant scarcity or perhaps even an absence, of papers concerning the DCs ecosystem at large. The concept of a DCs ecosystem represents a new dimension in the MA framework and will have its corresponding set of variants or options. Briefly, a DCs ecosystem should consist of elements such as input factors for planned development of DCs, the network of DCs within a firm, influencing factors that make the DCs effective, the outcomes of the DCs, measures of performance and success and feedback structures and mechanisms. Such additions of new dimensions and/or variants that could be triggered by the proposed MA framework will only help develop and consolidate the research literature further and make it as comprehensive, clear and cogent as it can be at any point in time in the future. Finally, we hope that our review provides fruitful directions for future research on DCs and their several related propositions.

Notes
1. Theoretically speaking, the word “complete” is not an accurate expression because the MA framework representations of a chosen concept or technology/product (which is more often the context) are complete only up to a point in time. One of the greatest constructive characteristics of the MA framework is that it enables, by design, evolutionary representations of further continuing or emergent developments that could arise from creative inputs and eventually even grow to become innovations. In this sense, MA frameworks could be considered as bases for systematic or structured creativity. It is quite possible that following the MA framework representation provided in this paper, others may creatively identify further “dimensions” or “variants” pertaining to DCs and enrich the field.

2. The color coding presented in Figure 1 is only of nominal interest, namely, to help identify different sub-groups of dimensions, sub-dimensions and variants. There is no other implication.


**Further reading**


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Exaptation in management: beyond technological innovations

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Abstract
Purpose – Although exaptation is recognized as a means of creation capable of generating significant economic implications for organizations, this mechanism has not been explored in depth in the field of management, where it remains restricted to innovation and product research and development. With this limitation in mind, this study aims to explore and discuss exaptation along with other entities that are more greatly concerned with the interests of and direct contact with practitioners and academics in the field of management, such as processes, data, tacit knowledge and skills.

Design/methodology/approach – For the purposes of this study, a comprehensive review of the literature on exaptation was conducted, and 46 entrepreneurs from companies of different sizes and segments were interviewed.

Findings – The results of the review of the literature and interviews with entrepreneurs helped to identify and describe 13 cases of exaptation associated with nine different kinds of organizational entities. For four of these entities, which are closely associated with management, the restrictions of the business environment regarding the exaptation of these entities are discussed, together with the more favorable organizational structures for their occurrence.

Practical implications – This paper discusses the exaptation to the four types of entity closely linked with management: tacit knowledge, data, process and skill. For each one of these entities the following is discussed: the organizational characteristics that hinder the exaptation of the entity in question and the managerial actions that could alter these characteristics and facilitate the occurrence of the exaptation mechanism with the entity in question.

Originality/value – This process led to the development of an algorithm for analyzing the exaptation mechanism and the adaptation of the attributes associated with the agent-artifact[entity]-context tripartite to describe and analyze exaptation event, including another attribute: the type of entity.

Keywords Creation, Context, Agent, Exaptation, Latent function

Paper type Research paper

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1. Introduction

Exaptation: (biology) the process by which features acquire functions for which they were not originally adapted or selected. (Oxford Dictionary, 2017)

The term exaptation was coined recently, defined by the paleontologists Gould and Vrba (1982), and its meaning continues to develop, with a history of confusing and even contradictory texts (Garud et al., 2016). “There seems to be little methodological and epistemological criteria that help operationally identify and analyze exaptations” (Andriani and Carignani, 2012, p. 4). In the field of social sciences, the term exaptation is not widely used and its potential remains latent (Andriani and Carignani, 2012). In management journals, there are few texts on the theme: 12 articles, as we will see in the literature review presented in the Findings section. These articles mostly focus on the application of exaptation with technological products, more specifically innovation, targeting professionals in the field of product engineering or research and development (R&D). As it is characterized as an important creation mechanism, with attributions of new functions for the entities (Lane, 2011), some of these articles explore the potential for exaptation in terms of economic implications, pointing out several significant examples, such as Viagra (Dew et al., 2004). Other articles address its importance in entrepreneurship, placing it among the ten main mechanisms in the making of entrepreneurial entities (Venkataraman et al., 2012). The utility of exaptation in organizational contexts comes from the potential to maximize the use of and returns from already available resources as well as avoiding unnecessary investments in new resources. This utility is independent of the size or economic sector of the firm.

In the field of management, there are many opportunities to research and practice exaptation, as organizational environments are characterized by a large number and great diversity of entities (Van Aken and Romme, 2009). Many entities of interest to management are intangible, such as methods and processes, as observed by Gregor and Jones (2007, p. 319), compared with the artifacts in the field of software engineering: “the field of management is less concerned with the design of products than with methods or processes”. The application of exaptation in the extant literature is limited in both range and relevance regarding entities of interest to the responsibility of managers. Despite this, existing work suggests the potential application of exaptation to other organizational entities. Dew and Sarasvathy (2016), for instance, mention the possibility of exaptation of processes skills and the organizational itself as a whole. Lane (2011) describes organizations as entities composed of structure, function and process, claiming that they are open to exaptation. Cattani (2005) stresses the possibility of the exaptation of a set of skills and knowledge of organizations. In the bibliographies of these three articles, we found only one article that deals with exaptation of an entity typical of administration, published in an administration outlet; Dew and Sarasvathy (2016) cited Marquis and Huang (2010), which deals with exaptation of processes.

It is important to observe that the literature involving cases and examples of exaptation in organizations comes from the field of engineering and is associated with product innovation. To cite two of the most cited examples, we have one from chemical engineering, the exaptation of the molecular entity sildenafil citrate, applied initially to the function of pulmonary arterial blood pressure control and later to erectile dysfunction (Dew and Sarasvathy, 2016) and one from telecommunications engineering, the radio frequency magnetron, initially used in air traffic control radar and later for cooking, generating a new category of equipment: microwave ovens (Mastrogiorgio and Gilsing, 2016). In this paper, we do not consider exaptation involving entities like molecules or radio frequency, which are
found in technological applications. Instead, we investigate the incidence of exaptation in other entities of direct interest to administrators, like data, skills, tacit knowledge of employees and organizational processes. Thus, our objective in this research is to develop content and discussion of exaptation in the areas of administration, those closest to the interests and concerns of administrators. Our purpose is to show researchers and practitioners in administration that exaptation may be used in organizations far beyond laboratories and new product development, being applicable in the direct responsibilities and activities of managers.

For exaptation to occur in organizations, not only is an entrepreneurial attitude required to intentionally activate a latent function of the entity (Villani et al., 2007), but also a “prepared mind” that allows the entrepreneur to identify the possibilities of exaptation around him (Andriani et al., 2015). Mastrogiorgio and Gilsing (2016, p. 1421) defined this demand as the domain of analogical ability, in other words, “ability to draw analogies between different technological domains”. Focusing on exaptation in the specific context of administrator or manager, this research seeks to facilitate the development of a “prepared mind” for these professional. The cases identified and described in this research may provide examples for administrators, facilitating analogies to the entities found in her daily work and increasing the potential for identification and execution of exaptation activities which speak to needs and opportunities in her organizations.

To frame a more effective contribution to the management literature by working with lacunae in the extant literature (Locke and Golden-Biddle, 1997) in different entities of interest to administration, we decomposed our principal objective into two specific objectives:

1. to structure and describe the cases identified in the literature and together with entrepreneurs, categorizing them according to the type of entity that was the object of the exaptation and identifying the kinds closely linked to management and the actions of managers; and

2. to discuss the characteristics that obstruct the understanding and practice of exaptation along with different types of entities closely linked to management in theoretical frameworks and administrative practices.

By doing this, we can identify organizational structures that allow it to be promoted, discussed and understood in the context of management.

2. Literature review
2.1 Entity and entity type
We used the concept of “entity” following the principles of data modelling from the field of computer science: “an entity is a “thing” which can be distinctly identified. A specific person, company, or event is an example of an entity.” (Chen, 1976, p. 10). Another concept from data modelling used in this research is “entity type” (Bornberg-Bauer and Paton, 2002, p. 167):

[...] an entity type provides a description of the properties that are shared by a collection of entities in a domain. For example, Protein could be an entity type, with attributes including sequence, name, molecular weight, accession number and species. A single entity type is expected to have many instances, each of which gives values to the attributes specified in the corresponding type.

2.2 Exaptation: agent, artifact and context
Exaptation involves discovering and putting into practice an entity’s latent functionality, with the entity beginning to perform a totally different function from performed hitherto. Let
us take as an example the exaptation that occurred with the drug sildenafil citrate, which was originally marketed to treat pulmonary arterial hypertension (Revatio) and later identified as suitable for treating erectile dysfunction (Viagra). The same active principle was applied originally in the field of cardiology and later in the field of urology (Dew and Sarasvathy, 2016). Thus, the Latin prefix “ex”, meaning moving away from, exiting, extracting, which before the word aptation comes to indicate that the entity is shifting from its original purpose to perform another role in a new context. Therefore, in an exaptation kind of innovation technological continuity and functional discontinuity are observed (Andriani and Carignani, 2014). This is the opposite of what is observed in adaptation type mechanisms, in which new forms perform old functions. In exaptation, new functions for old forms are observed (Dew and Sarasvathy, 2016).

Exaptation is pervasive in the business world and is subject to application by managers in different organizational entities (Dew et al., 2004). These entities may be “artifacts, technologies, processes, skills, organizations, and resources for emergent uses that they were not (initially) designed for” (Dew and Sarasvathy, 2016, p. 167). These numerous forms of occurrence are more commonplace in the business environment than might be imagined and are often confused with and referred to as mechanisms of adaptation (Dew et al., 2004). For exaptation to occur, it is necessary for its agent to have an entrepreneurial attitude, as highlighted by Ganzaroli et al. (2014, p. 256): “exaptation does not only require luck, but also and foremost entrepreneurship”. For the entrepreneur, exaptation is especially attractive because “extracting such latent value is, theoretically, cheaper than creating new artifacts for new functionalities as the creation process itself is costly” (Andriani et al., 2015, p. 2). Because of its potential to aid entrepreneurs in building new ventures and new markets, exaptation is considered one of the ten principal techniques of entrepreneurship (Venkataraman et al., 2012).

An entity that undergoes exaptation must be coopted by the group of customers that demand that function in that context, as it “must have a function and must enhance the fitness of its bearer to qualify as an exaptation” (Buss et al., 1998, p. 539). This helps to distinguish exaptation from bricolage, which is also recognized as “an ad hoc quick fix that is ephemeral” that “was not designed” and “never became the basis for new commercial products” (Garud et al., 2016, p. 160). Exaptation involves delivering an effective solution that is as good as or better than the other solutions available for that function in that specific context. The importance of the context is critical here. It is one of the three components of the agent-artifact(entity)-context tripartite described in the “integrated model of exaptation” of Andriani and Cattani (2016) for the description and synthesis of the exaptation mechanisms. In this model, the following definitions for the three central concepts are given:

1. agent, the one who has some level of mastery of the entity and uses her analogical skills to identify a new function;
2. artifact, characterized as the entity employed in a new function, in other words, the one that suffers a functional shift (in this study we refer to an artifact as an entity that encompasses the tangible and intangible equally); and
3. context, the space in which the entity comes to be used by the agent, other than the original purpose for which it was conceived.

An important premise of this model is that “functions are not a property of the artifact [entity] but instead express a relation between the artifact and other artifacts and/or agents within a specific context” (Andriani and Cattani, 2016, p. 122).
3. Method
To identify, analyze and discuss cases published in the literature that characterize new attributions to entities of interest to managers, also including those that were not given the label of exaptation recently imported from paleontology, we began with a review of the literature. An initial search identified the presence of the word exaptation in the title, abstract or keywords of articles. This step was taken in May 2017, in four digital libraries of scientific articles specializing in the field of Management: EBSCO, JStor, ProQuest and Academy of Management Publications. The authors used skimming to read the articles that resulted from the initial search (Duggan and Payne, 2009), reading the abstract, introduction, section headings, subsection headings, tables and figures. At this time, the articles related to management and related fields (accountancy, economics and engineering) were separated from the other fields, such as biology, linguistics and psychology. Following these two selection processes, the articles were distributed among the authors for intensive reading. The dimensions for the content analysis of the texts were defined as six codes to be observed:

1. the type of exaptated entity;
2. exaptation agent;
3. initial function (original);
4. final function (exaptated);
5. form of exaptated entity, whether preserved or altered (reduced, increased or adapted); and
6. performance in the new function of the entity, if equal or superior to the other entities already available.

To identify articles with examples of exaptation published before the introduction of the term in the field of management, the authors resorted not only to their own personal files but also consulted their peers, teachers and specialist researchers, in a diversity of entities and subfields of Management. They asked their peers to identify cases in the literature that characterized events involved in exaptation. For this, a brief 10-min description was given in private to each of the peers who were consulted, presenting the classic cases of technological exaptation and some cases of exaptation of entities of interest to management, which were identified by the researchers themselves in the first instance. For the researchers to analyze all the cases identified, either under the name of exaptation or some other name, a sense making analysis of alternate templates was applied (Langley, 1999). After consolidating the characteristics of the exaptation mechanism identified in the literature review, a template was developed in the form of an algorithm to distinguish the exaptation events from the other mechanisms for the creation of entities. The algorithm employed as a template is described in Appendix 1.

The logic of the algorithm was developed, tested and refined as the researchers analyzed the first texts. One of the challenges of this process would be to define the level of difference between the original and final functions. According to Andriani et al. (2017, p. 324):

[...] the decision of whether two functions (of the same artifact) are sufficiently different is based on judgment, and there are borderline cases in which the decision may be somehow arbitrary.

The perception of this difficulty in practice led us to define the six analysis codes associated with the dimensions for the content analysis already described and understand the importance of correctly identifying and describing them. For example, we cite the case of competence transfer that occurred at American Airlines (AA). When the company achieved
a high level of competence in the management of ticker reservation, it created a spin-off of this area, treating it as a new business unit, with consultancy for reservation management in the hotel sector and the entertainment industry (Probst et al., 1999). The discernment of the analysis occurred when we identified the type of entity involved, defining it as a process (reservation). Following this, in the second question of the algorithm (according to the rhombus in Appendix 1), it was perceived that the later function was not sufficiently different from the original. Both deal with reservations, only changing the object, shifting from plane seats to seats in theaters, cinemas, cabins on a ship or amusement parks. Thus, the case was classified as exploration of new possibilities for a differentiated competence of the company. With exploration closely linked to adaptive systems (March, 1991), the case of AA is more like a mechanism of adaptation to make reservations in new contexts.

To verify with experienced entrepreneurs, examples of applying exaptation mechanisms in their ventures we used focused interviews (Flick, 1998) with entrepreneurs who had at least 42 months’ experience (Reynolds et al., 1999). In the focused interviews, entrepreneurs were asked to describe the history of the creation and evolution of their families of products and services. This helped the researchers to become more familiar with the business of the entrepreneurs, introducing the theme of exaptation more comprehensively, using examples and the daily situation of the entrepreneurs. Thus, in the first part of the interview, the researcher presented examples of exaptation and eight other kinds of creation mechanisms used by entrepreneurs for the development of families of products and services. The purpose was to present with the entrepreneur with the action of application, the transposition of an exaptated entity as something pertinent to other creation action, in other words, another form of diversification of families of products and services. Therefore, in addition to transporting/applying, actions involving copying, creating/developing, improving, simplifying/reducing, adapting, composing/combining, using and reusing were also discussed. We associate them, respectively, with the mechanisms of creation by copy, new product development (NPD), improvement, frugal innovation, adaptation, new combination, nonaptation spandrels and nonaptation junk, all described in Appendix 2.

The list of creation mechanisms we describe in Appendix 2 is not meant to be exhaustive. It is meant only to illustrate some of the different kinds of procedures for creation of products and services used by entrepreneurs as a means of facilitating discussion during the focused interviews. Although these mechanisms are more frequently cited in the innovation literature and used in R&D applications, exaptation is also found in other areas relevant to administration scholars and practitioners. For example, the logic of exaptation is cited as one of the transformation strategies employed by expert entrepreneurs in the discovery and creation of new markets (Goldenberg et al., 2001; Dew et al., 2011). In Dew et al. (2011, p. 242), exaptation is seen as one of a “variety of transformation procedures performed by the expert entrepreneurs” to identify and create new markets. They include exaptation with a number of specific mechanisms associated with new markets including stereotyping, free associating, prototyping and globalization operations (Dew et al., 2011). Although exaptation is the only construct included in both lists, there are some other mechanisms which, despite different names, present the same semantic value and are associated with the same logic in terms of the behavior of the entrepreneur.

We chose to present to the interviewees the typology of mechanisms for creating products and services (Appendix 2) and not the typology for creating new markets because the former is simpler and closer to the daily life of the diverse community of entrepreneurs that composed the sample of our research. Dew et al. (2011) point out that the typology of transformation procedures is associated with events which are rarer – the creation of new markets – associated with expert entrepreneurs as highlighted by Dew et al. (2011). The
The presence of exaptation in both typologies is important to be analyzed. Its presence as a mechanism of new market creation approximates exaptation to the concerns of marketing and economics. In Dew et al. (2011, p.231), abstract, the authors stress the importance of exaptation to the field of economics: “The generation of new markets is an emerging area of interest among researchers working in the traditions of evolutionary economics”. These multiple uses of exaptation indicate its importance to contemporary society and its importance to scholars and practitioners in administration.

In the second part of the interview, the entrepreneurs were asked to comment on the mechanism employed to create and expand each family of products and services that they developed and sold in their ventures, identifying the kind of creation mechanism used. We classified the families of products and services created by the entrepreneurs according to the different types of mechanism used. The resulting list was then presented to the entrepreneurs and they were asked to judge their level of mastery and knowledge of each of the nine mechanisms using a Likert scale, giving examples to portray their mastery irrespective of whether the experience was linked to new products and services. This procedure involved 46 entrepreneurs, as described in Table I. The interviews took place from May to August of 2017 at the workplace of the entrepreneurs, with an average duration of 87 min.

<table>
<thead>
<tr>
<th>Experience as entrepreneur</th>
<th>Business segment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>02–05</td>
<td>Accountancy</td>
<td>3</td>
</tr>
<tr>
<td>06–10</td>
<td>Animal health</td>
<td>2</td>
</tr>
<tr>
<td>11–15</td>
<td>Architecture and Landscape</td>
<td>3</td>
</tr>
<tr>
<td>16–20</td>
<td>Body esthetics</td>
<td>2</td>
</tr>
<tr>
<td>21–25</td>
<td>Clothing</td>
<td>1</td>
</tr>
<tr>
<td>26–30</td>
<td>Construction</td>
<td>3</td>
</tr>
<tr>
<td>31–35</td>
<td>Consultancy</td>
<td>1</td>
</tr>
<tr>
<td>36–40</td>
<td>Difficult access services</td>
<td>1</td>
</tr>
<tr>
<td>41 or more</td>
<td>Engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Entertainment</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Food</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schooling</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Foreign trade</td>
<td>1</td>
</tr>
<tr>
<td>Secondary</td>
<td>Furniture</td>
<td>1</td>
</tr>
<tr>
<td>Higher</td>
<td>Gifts</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Healthcare</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Hotels</td>
<td>1</td>
</tr>
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</table>

<table>
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<tr>
<th>Sex</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Law</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>Packaging</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Photography</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Printing</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total families of products and services developed by the entrepreneur</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 family</td>
<td>8.5</td>
</tr>
<tr>
<td>2 families</td>
<td>13.0</td>
</tr>
<tr>
<td>3 families</td>
<td>39.5</td>
</tr>
<tr>
<td>4 families</td>
<td>26.0</td>
</tr>
<tr>
<td>5 families</td>
<td>4.5</td>
</tr>
<tr>
<td>6 families</td>
<td>4.5</td>
</tr>
<tr>
<td>7 families</td>
<td>2.0</td>
</tr>
<tr>
<td>8 families</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table I.
Description of the 46 entrepreneurs interviewed
Having identified the different cases in the literature and from the entrepreneurs, we had the content necessary for the first specific goal:

[...] to structure and describe the cases identified in the literature and together with entrepreneurs, categorizing them according to the type of entity that was the object of the exaptation and identifying the kinds closely linked to management and the actions of managers.

For all the cases identified, we proceeded to analyze the essence of the exaptated entity to distinguish the cases associated with entities of interest to professional managers and the field of management from those associated with entities of interest to other professionals in other fields, such as exaptation of techniques specific to psychology or psychopedagogy. Having documented and separated only the cases of interest to managers, we clustered these cases by type of entity of broad interest to managers. In other words, entities in all the organizations irrespective of their size or sector.

With the cases of exaptation in management identified and classified by entities of interest to management, we had the input necessary for activities associated with the second specific goal (“to discuss the characteristics that obstruct the understanding and practice of exaptation along with different types of entities closely linked to management in theoretical frameworks and administrative practices”). This was discussing the characteristics that obstruct exaptation of the types of entity closely linked to management in theoretical frameworks and administrative practices, identifying organizational structure to promote its occurrence, and discussing and understanding it in the context of management. For each kind of administrative entity identified, the researchers resorted to their personal contact networks in several subfields of management to look at the conditions that hinder conventional companies when it comes to the exaptation of that specific type of entity. For each obstructive aspect, we also questioned the possible administrative practices and actions that could emerge in the organizational environment to eliminate or lower the barriers to exaptation. The information was given to the group of researchers-authors, who organized and consolidated the information from their peers. These ideas were also critiqued, reflected on and integrated. All of these activities associated with data collection and analysis are summarized in the visual research chart in Figure 1.

4. Findings

4.1 Identified cases of exaptation of administrative entities

From the literature review on exaptation, we identified four articles containing examples of four different exaptated entities, all of them different from the classic examples of technological products. Two of these four entities are closely linked to management. In other words, they are present in organizations of any size or segment: process entity and skill entity. The other two entities identified were concept entity and communication channel entity. When analyzing cases published under a name other than exaptation, we identified one case involving an entity closely linked to management: the data entity. When gathering data in the field during interviews with entrepreneurs, we identified another eight cases of exaptation, two involving entities closely linked to management: skill entity and tacit knowledge (of employees) entities. The other six cases identified with the entrepreneurs involved the following entities: professional techniques, with three cases; material input, with two experiences, and one case involving the production equipment entity. Thus, we identified a total of 13 cases, associated with nine different types of entities. Of these 13 cases, 5 are associated with entities closely linked to management: data, process, tacit knowledge and skill, the latter with two occurrences identified. These five cases are described in Table II, while the others are described in Appendix 3.
4.2 Discussion so far in management journals

For all the articles resulting from the skimming research, identified as pertinent to the context of management, the background of the journal was checked in terms of its associated fields of science. For this purpose, we consulted in the Scimago Journal Rank the metadata subject area associated with each journal. This process identified 11 different journals in the field of management that published 12 articles on exaptation: *Academy of Management Journal* (Marquis and Huang, 2010), *Economics of Innovation and New Technology* (Bonifati, 2010), *European Management Review* (Villani et al., 2007), *Innovation: The European Journal of Social Science Research* (Ganzaroli et al., 2014), *Journal of Economic Behavior and Organization* (Dew et al., 2008), *Journal of Evolutionary Economics* (Dew et al., 2004), *Journal of Management and Governance* (Abatecola et al., 2016), *Organization Science* (Andriani et al., 2017), *Research Policy* (Andriani and Carignani, 2014; Mastrogiorgio and Gilsing, 2016), *Technological Forecasting and Social Change* (Banerjee, 2012) and *Technovation* (Desouza et al., 2007). With the exception of the article by Marquis and Huang (2010), addressing the exaptation of a process, all the others looked at cases and examples associated with technological product innovation. In short, the exaptation literature available in the field of management is restricted to few articles and from a pragmatic viewpoint exclusively addresses cases and examples focusing on the innovation of technological products. This confirms the claims of Dew *et al.* (2004), who found that, despite the importance and pertinence of exaptation to entrepreneurship and companies, little attention has been paid to exaptation in the context of management by academia.
<table>
<thead>
<tr>
<th>Entity</th>
<th>Type</th>
<th>Agent</th>
<th>Initial function (original)</th>
<th>Final function (exaptated)</th>
<th>Comments on the case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supermarket sales</td>
<td>Data</td>
<td>Tesco (British multinational grocery and general merchandise retailer)</td>
<td>Registering sales data for financial control and replenishing stock</td>
<td>Registering sales data to analyze the lifecycle of the consumer and identify insurance needs</td>
<td>Britain's Tesco retail group successfully entered the insurance and tourism market after monitoring the shopping habits of its customers. This enabled them to identify events that characterized new needs. For example, the purchase of diapers was related to the birth of a child and a demand for life insurance. The purchase of sunscreen in Britain meant a trip abroad and thus a demand for travel insurance.</td>
</tr>
<tr>
<td>Evaluation of an external entity of a bank's head office</td>
<td>Process</td>
<td>Banking Institution in the USA</td>
<td>Bank branch management (control and monitoring entities outside headquarters but belonging to the bank)</td>
<td>Using the same process for bank acquisition management and integration (evaluation of external entities)</td>
<td>The method employed by the bank had been to manage its widespread branches was used to evaluate other banking institutions that were being considered for acquisition by the bank.</td>
</tr>
<tr>
<td>Enzyme production</td>
<td>Skill</td>
<td>Ms Kiran Mazumdar-Shaw (founder of Biocon)</td>
<td>Ms Kiran Mazumdar-Shaw had knowledge and practice of enzyme production techniques applied to the brewery industry</td>
<td>Ms Kiran Mazumdar-Shaw founded Biocon and applied her knowledge of enzyme production techniques to produce medicine in the pharmaceutical industry</td>
<td>Ms Kiran Mazumdar-Shaw studied in Australia to become a brew-master in India. A friend saw the potential of her technical skills with enzymes and invited her to form a company in the field of biotechnology.</td>
</tr>
<tr>
<td>Vertical climbing</td>
<td>Skill</td>
<td>Entrepreneur #13 initially founded a mountaineering company and later a company that provide industrial climbing services (chimney, silo, roof, tower, ... )</td>
<td>Entrepreneur #13 has knowledge and technical skill for climbing mountains, cliffs and other locations associated with the entertainment and leisure sector</td>
<td>Entrepreneur #13 applied his knowledge and climbing techniques to provide services to industries in locations of difficult access (heights)</td>
<td>Entrepreneur #13 climbed mountains on the coast of São Paulo (Brazil) when he was approached by the owners of a company that inspected and surveyed ships. They asked if he could help them to inspect the hulls of large ships. The first difficult access training job resulted from this contact. They went to an old building (building shell) and trained company employees to conduct surveys and inspections.</td>
</tr>
</tbody>
</table>

Table II. Examples of exaptation of entities closely linked to management.
Entrepreneur #14 founded a bus rental company (transport for industry employees). Entrepreneur #14 has an employee who worked as a bus driver on different routes for over 15 years in the same region. Entrepreneur #14 asked the employee to prepare routes to provide estimates for the company’s services to customers of the bus rental company. Entrepreneur #14 noticed that the driver, after 15 years, had a vast store of knowledge of the regional road system. Thus, the driver was assigned the task of preparing routes requested by customers. Even though applications such as Google Maps and Waze are available, this professional remained invaluable because of his additional knowledge, including the width of roads and turns, height of wires and bridges and safety in the region, aspects that have to be considered when preparing each route requested by customers.
4.3 Knowledge and practice of exaptation by entrepreneurs

During the interviews with 46 entrepreneurs, the history of the creation mechanisms they employed to launch 155 families of products and services was recounted. Many of them resorted to copy mechanisms (54 per cent) and NPD (20 per cent), as shown in Figure 2. The exaptation mechanism was identified in the origin of only 2 of the 155 (1.3 per cent) families of products and services described by the entrepreneurs. At the end of the interview, we asked the entrepreneurs about how well they considered themselves informed and competent to handle each of the nine creation mechanisms. Their responses are summarized in Figure 2: the copy mechanism is the one they have mastered best, with a median of 5, while the exaptation mechanism has a median of 1.5 on a scale of 1 to 5, with one corresponding to “no level of knowledge” and 5 “total knowledge of the mechanism”. Thus, we can affirm that the entrepreneurs consider themselves not well informed and competent with regard to exaptation (1.5), which is in keeping with the fact that it has been used little (1.3 per cent) as the principal mechanism for creating families of products and services.

5. Discussion of exaptation mechanism with entities of interest to managers

In this section, we analyze the cases described in the previous section to achieve the second specific research goal:

[... ] to discuss the characteristics that obstruct the understanding and practice of exaptation along with different types of entities closely linked to management in theoretical frameworks and administrative practices, identifying organizational structures that allow it to be promoted, discussed and understood in the context of management.

For this purpose, we have subdivided the discussion according to the four types of entity closely linked with management: tacit knowledge, data, process and skill.
5.1 Exaptation of tacit knowledge (of the employee)

As observed in the field, Entrepreneur #14, owner of a bus rental company, observed that after a bus driver had driven buses on different routes in the company’s region for over 15 years, he had accumulated considerable knowledge of the local road system. When no knowledge of the road system was available either in software or on paper, the company always asked this driver to map out routes to prepare estimates for customers. After a time, during which the company frequently consulted the driver, they realized that he would add more value to the organization as a traffic operator, preparing routes for trips and providing customers with cost estimates. Even after the advent of applications for mapping routes, such as Google Maps and Waze, this professional continued to be invaluable to the organization. He has distinct and integrated knowledge regarding aspects such as the width of roads and turns, the height of electrical wires, bridges and footbridges, safety in the region and other aspects not available from applications that influence the mapping of each route requested by customers. It should be highlighted in this case that the company did not possess any data or information; the employee did. This explains the expression “exaptation of tacit knowledge” (of the employee), as registered in the examples of Table II.

Employee competences can be characterized by knowledge, skills and attitudes (Le Boterf, 2000). Organizational recognition of the competences of each employee occurs naturally and spontaneously in small companies, where there is closer contact between managers and employees, as observed in the organization of Entrepreneur #14. For the managers of medium-sized and large companies, the literature recommends action in the sense of identifying, registering and updating the profiles of all employees regarding their skills, knowledge and attitudes (Capaldo et al., 2006). Administrative approaches that value human capital are increasingly important and receive more attention from academics and practitioners in management, as this resource is viewed as an essential part of the intellectual capital of organizations (Edvinsson and Malone, 1997). Thus, administrative practices such as competence management and the management of intellectual capital favor the occurrence of the exaptation mechanism applied to the tacit knowledge entity. These practices also encourage the registering and monitoring of employees’ knowledge, skills and attitudes.

5.2 Exaptation of data

From the literature review, especially the literature not labeled as exaptation, one data exaptation event was identified. In their book, Peppers and Rogers (2011) described the experience of British retailers Tesco with intensive data analysis of its customers’ purchases, which had hitherto been used for financial and stock control. By monitoring the evolution of these data, an analysis was developed of the customer profile and lifecycle stage, as described and exemplified in Table II. Following these analyses, Tesco became a new entrant in the insurance market, with differentiated information in relation to established companies in this sector. This was possible because of the exaptation of operational data stemming from Tesco’s relationship with its retail customers, enabling the organization to know the insurance requirements of its customers beforehand (Peppers and Rogers, 2011).

Most work on exaptation appears in journals in the field of engineering and innovation and does not directly mention the concepts and practices of information and knowledge management. However, there is a clear alignment of concepts and practices associated with the treatment of data in the organizational environment that can be understood as an instrument of exaptation, as highlighted by Andriani and Cattani (2016, p. 119):
One such mistake is to overlook that the range of possible applications for a firm’s knowledge base is typically wider than its current applications. Firms can in fact capitalize on previous investments by transferring knowledge already available in-house to new applications, a capability that Garud and Nayyar (1994) have defined as transformative capacity.

In the taxonomy for management schools of knowledge management, there is a type known as the Strategic School, in which some companies pay considerable attention to their data, treating them as the main asset of the organization (Earl, 2001). In the Strategic School, the focus is the mindset, in other words, a fixed state of mind, a mental attitude of the organization’s employees when considering and treating the organization’s data as the essence of the firm’s strategy. “The strategic school is essentially concerned with raising consciousness about the value creation possibilities available from recognizing knowledge as a resource” (Earl, 2001, p. 228). Companies that value and work with their data can go beyond improving products or generating new products and services, positioning themselves strategically in a new sector with a differential in relation to those already established in the sector, as in the case of Tesco.

5.3 Skill exaptation

During the literature review, we found a case of skill exaptation in the text of Dew and Sarasvathy (2016). When interviewing Entrepreneur #13, we identified another case. Both are described in Table II. In these cases of skill exaptation, the opportunity did not occur through the direct actions of the entrepreneur, but from the action of a third party with demand for the entrepreneur’s skill, as shown in the comments on these cases in the fourth column of Table II. In the case of Entrepreneur #13, the service of climbing to provide services to industry in difficult access locations began with an invitation from the owners of a company that inspected and surveyed ship hulls, who went to the hills on the coast where the entrepreneur was climbing as a sporting activity. In the case of Kiran Mazumdar-Shaw, a friend recognized the potential of her technical skills with enzymes and invited her to open a company in the field of biotechnology (Dew and Sarasvathy, 2016). Although in both cases the experiences resulted in success for the entrepreneurs, the way in which the opportunities were identified was not ideal. They depended on a third party outside of the organization or the entrepreneurial being. We will now discuss propositions to make skill exaptation less random and less dependent on a chance act of a third party.

Exaptation being a mechanism of heuristic creation goes against common sense, associated with the mainstream of the rationalist paradigm for problem solving, which demands a clearly defined objective. In the constructivist approach, the entrepreneur uses diverse creation mechanisms, such as adaptation, improvement and reduction until the desired goal is achieved. Although there is no initial objective in exaptation or guide to induce actions, we should not consider it as a random creation mechanism associated with the entrepreneur’s luck. As highlighted by Andriani et al. (2015), a “prepared mind” is needed. Preparation is fundamental, especially for those with fewer resources. Let us take the example of freelance entrepreneurs whose main resource (often their only resource) is their skill at a certain activity. To train such professionals in the exaptation mechanism, it is very important to transmit the concepts of the literature on effectuation, contrasting it with the literature on causation (Fisher, 2012). They need to be aware that it is possible to apply effectual logic to develop exaptive strategies (Dew et al., 2008). They need to be aware that for this only their current skills are required, with no need for a financial outlay. If one of their skills is analogical ability, they can apply it to their other skills and knowledge. In other words, this is the exaptation of their competences to optimize their current operations or
even create new lines of products and services. They can even begin to operate in other contexts, others business sectors (Dew et al., 2008).

5.4 Process exaptation
Of the different types of entity analyzed, the process was the most recurrent in terms of the available literature in articles and book chapters. Of this set, only one article was identified as an example of the occurrence of the exaptation mechanisms: the one used to evaluate the entities outside of the headquarters of a bank (Marquis and Huang, 2010), described in Table II. Many cases involving processes were characterized as improvement, frugal or adaptation mechanisms, as in the case of the AA reservation process mentioned in the Method section. Despite only one occurrence, the potential for exaptation of the process entity should be stressed. There is a growing background of methods, techniques and tools for organizational processes. In this shift, the following actions should be highlighted: workflow, business process improvement, business process design, business process notation, business process management system, business process execution language and others (Wong et al., 2014). These initiatives have not only promoted the explanation and specification of processes, such as the evolution of metadata and meta-information, they have also organized them into repositories of content on processes (Hoang et al., 2014). This scenario, linked to the development of protocols and tools to search, analyze and share this content, should promote the reuse of specifications and algorithms on processes. This will facilitate the identification, transposition and application of these into other contexts, including functions different from those for which they were conceived.

Winter and Szulanski (2001) stress that the replication of processes is a “familiar phenomenon” in organizations, confirming the wide diffusion and use of the copy mechanism in organizations, as can be seen in Figure 2. The debate in academic circles urges managers to go beyond simple replication of processes – that is – to go beyond exploitation, recommending exploration (March, 1991). Exploration is defined “by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation” (March, 1991, p. 71). These terms do not suggest meanings which can be directly linked to functional discontinuity – a central characteristic or exaptation. For this reason, it is important to promote the noun exaptation in the vocabulary of administrators, highlighting the dyad of technological continuity and functional discontinuity as one mechanism of creation.

5.5 Exaptation as a mechanism overlapping others
In the texts on technological innovation, it is pointed out that exaptation is never an isolated creation mechanism. From the perception of functional alteration of a given entity, there is a need for actions to adapt it so that it can exercise a new function, in other words, exaptation being succeeded by an adaptation mechanism (Andriani and Carignani, 2014; Shumacher, 2012). For the exaptation mechanisms identified in the interviews with the entrepreneurs, we explored the actions of these entrepreneurs to enact the exaptation imagined by the entrepreneur. From this procedure, we observed that not only does adaptation occur, but various other creation mechanisms are also activated from the conceived exaptation. Table III describes the other overlapping creation mechanisms that were identified in the interviews with the entrepreneurs. It is interesting to highlight the intertwining of the different creation mechanisms in acts of exaptation, as this characterizes the risk that someone analyzing the act might understand it and classify it in different ways because of the diversity of overlapping creation mechanism. In short, it is a complex event, with many interrelated actions and requires conceptual support. In this sense, this study proposes to
<table>
<thead>
<tr>
<th>Entity (entrepreneur)</th>
<th>Creation Mechanisms Overlapping with the Case of Exaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical climbing</td>
<td><strong>Improvement</strong> At the time of the exaptation (2005), in Brazil there were no technical recommendations or norms for climbing as a sport. In industry, there were only some recommendations. The team had to specialize by doing training courses overseas: High Rise and Confined Space Rescue by ROCO Rescue (USA); Confined Space Rescue at Texas A&amp;M University and Emergency Services Training Institute (USA).</td>
</tr>
<tr>
<td>(Entrepreneur #13)</td>
<td><strong>Adaptation</strong> Behavioral. When climbing for leisure, the environment is more relaxed: there is greater tolerance of latecomers to begin activities and the communication pattern is full of slang and informality. The industrial environment required adaptations considering that punctuality is important because of the large number of actors involved in the activity and the formal communication pattern. This led Entrepreneur #13 to hold speech courses to improve communication with practical and theoretical courses given in the industrial environment.</td>
</tr>
<tr>
<td>Understanding of a</td>
<td><strong>Improvement</strong> Developed interpersonal relationship courses for attending meetings with company clients to understand the transport requirements of client company employees. Training in the use of the computer (workstation) to use itinerary preparation software identifying the homes of clients’ employees.</td>
</tr>
<tr>
<td>regional road system</td>
<td><strong>Adaptation</strong> Stopped working day shifts and night shifts to work exclusively during the day. Requires dialogue with customers to understand their demands and dialogue with the bus company’s administrative professionals who work during the day.</td>
</tr>
<tr>
<td>(Entrepreneur #14)</td>
<td><strong>Frugal Innovation</strong> Using software, he diverted the initial activation of the calculator (initial boot) to another part of the memory, where the applications were stored. This avoided activating native functions recorded in the ROM. In other words, it disabled the forced use of several native functions to obtain more space and processing capacity for its applications.</td>
</tr>
<tr>
<td>Programmable</td>
<td><strong>New Combination</strong> He inserted a radio plate (WI-FI) into the calculator to communicate data to the rear server that processes customer orders; he integrated the code reader for some restaurants that had barcodes on their menus. He also developed the integration of equipment as a magnetic reading device (slot reader) and with RFID tags.</td>
</tr>
<tr>
<td>calculator</td>
<td><strong>Adaptation</strong> Concealing several keys of mathematical functions on the programmable calculator keypad by applying the pad printing technique to facilitate the operation of the equipment in the field. Using programming resources, he altered the functions of each key to have a complete set of alphanumeric characters.</td>
</tr>
<tr>
<td>(Entrepreneur #2)</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** This case is described in Appendix 3
make a small contribution through examples from the organizational area and the introduction of the algorithm to analyze possible exaptation events (Appendix 1).

5.6 Adjustment of attributes that describe the entity in question
Of the experiences analyzed in the cases outlined above, the researchers observed the importance of correctly defining the type of entity to be considered in the analysis, at the risk of undue classification of the mechanism employed by the entrepreneur. Let us take the example of the kind of entity associated with the case of the bus driver employed by Entrepreneur #14. If instead of considering the type of entity as “tacit knowledge”, we had considered it as “employee”, we would have classified the action as an adaptation rather than exaptation, as we would have changed not only the function of the employee but also his form. As highlighted in Table III, the employee needed to develop interpersonal relationship skills to attend meetings with client companies (hitherto, talking was not a desirable function for a bus driver, who drove in a space on the bus reserved only for himself). He also had to adapt to new working hours. By altering the focus of the analysis, identifying the type of entity as tacit knowledge and not as employee, the case can be presented as exaptation: “new functions for old forms” (Dew and Sarasvathy, 2016); in other words, the essence of the entity used in the creation mechanism, tacit knowledge, remains unaltered.

In the field of management, where the practitioner (manager) handles different types of entities, many of them intangible and complex, it is fundamental to have a more specific qualification of the concept of entity, associated with the agent-artifact-entity-context tripartite of the “integrated model of exaptation” (Andriani and Cattani, 2016). In this respect, we consider it necessary to include the attribute “type of entity” to describe the entity of the case to be analyzed. Therefore, this attribute should be added to the other two attributes of context that have already been mapped by the models developed by authors of technological innovation, the initial function and final function, as described in Table II.

5.7 Managerial implications
For the four types of entity closely linked with management (tacit knowledge, data, process and skill) we analyze in this subsection:

- the organizational characteristics that hinder the exaptation of the entity in question; and
- the managerial actions that could alter these characteristics and facilitate the occurrence of the exaptation mechanism with the entity in question.

5.8 Entity tacit knowledge
The obstacles to the exaptation of tacit knowledge (of employees) include:

- the people management area ignores the value of explicit knowledge of company employees; and
- practices related to exploitation of existing knowledge as yet have seen little use in organizations (Akhavan et al., 2006).

To promote the exaptation mechanism with the knowledge of company employees, positive actions would be:
to develop the concept of valuing assets that are already available in the organization as inputs for creation, in other words, using effectual reasoning as an instrument of intrapreneurship, valuing the knowledge of employees as an important individual asset to be made explicit; and

practice competence management, describing the intangible assets of each individual as resources that constitute their competence (knowledge, skills and attitudes) subject to exaptation.

5.9 Entity data
The obstacles to the exaptation of data include:

- predominance of the traditional culture of data processing, where this resource is perceived as indirect material only to support production activities rather than an input, a resource available for creation; and
- a limited view of data collection by the organization because of technological restrictions that lead the information system to create data silos, hindering more complex creations that require the reading and combination of data from different context.

To promote the exaptation mechanism with the data entity, the positive actions are:

- adoption of a strategy for knowledge management of the Strategic School type (Earl, 2001) that values data as an important organizational input; and
- making a technological environment available, such as a data warehouse, which allows an integrated view of the different data sets of the organization.

5.10 Entity skill
The obstacles to skill exaptation include a description of skills closely linked to the process and function currently performed by employees, without capturing their essence, obstructing their understanding and application to the new context and with a new function; the people management area does not have an explanation of the skills of the company’s employees.

To promote the exaptation mechanism with the skill entity, the positive actions are:

- developing the concept of valuing the organization’s already available assets as input for creation, in other words, working on effectual reasoning as an intrapreneurship tool, valuing skills as important individual assets to be explained; and
- practicing management by competences, describing the intangible aspects of each individual as constituent resources of their competence (knowledge, skills and attitudes) subject to exaptation.

5.11 Entity process
Obstacles to the exaptation of processes include intangibility of processes because of a lack of specification. Even when there are specifications, they are often outdated and do not correspond to what actually occurs in the operation of the company. To promote the exaptation mechanism with the process entity, the positive actions are adoption of
technological environments to manage processes, associating execution and monitoring of processes with their specification, requiring integration and synergy between the specified process and the process being executed.

6. Conclusions
The discussions in the previous section contrast with the extant literature on exaptation, which mostly focuses on entities directly associated with technological products of big organizations, with high investments in R&D. We discussed exaptation citing companies of different sizes from different sectors, involving other types of organizational entities, more specifically those that are the direct responsibility of or highly dependent on the actions of managers. In terms of implications for future research, our contribution is to present and provide examples of entities of interest to and direct usage by managers which may favor the use of exaptation. The means related activities carried out by different areas of the organization may also benefit from the use of exaptation mechanisms. That is to say, exaptation may be used beyond the company's core activity and beyond the area of product engineering or R&D.

Examples of the cases collected from the entrepreneurs and the literature, classified by types of organizational entities, aid the perception and debate of limiting aspects of companies in terms of the practice of the mechanism of creation through exaptation. We based our discussions on theoretical frameworks and recent administrative practices, pointing out means for reducing the barriers against the exaptation of each type of entity. Current literature is often criticized for being limited to good stories of innovation episodes to stimulate good insights that might spur organizational innovation (Andriani and Carignani, 2012). Thus, we made an effort to go beyond these limitations to provide a more pragmatic viewpoint of the actions of the manager with regard to exaptation. In terms of teaching, we understand that the article also helps teachers of management to address exaptation, using types of entities other than the innovation of technological products. This allows teachers of management to select the type of entity that is more convenient according to their expertise, the program for their discipline and the profile of their students.

In this study, we did not address how to practice and develop analogical ability. However, we addressed a necessary input for its occurrence: providing information to a manager or future manager, knowledge of organizational entities subject to exaptation. Besides highlighting the different types of examples of possible entities for exaptation, we addressed administrative approaches and practices that require the organization and its employees to adopt an analytical posture in terms of having knowledge of entities. All the administrative approaches or disciplines discussed in the previous section also require the structuration and description of the content of the entities associated with their respective fields. This is an ontological issue of understanding and making understood the different instances of the different organizational entities by all those involved in the implementation and use of administrative practice. The correct functioning of these practices requires wide-ranging reflection of the entities involved, breaking them down into as many attributes as necessary, giving these a set of descriptive properties. In practice, it requires conceptual modeling of data associated with the entities, which can be researched, read and understood by everyone in the organization. This makes it easier for company employees to know more about the entities available in the organization, both tangible and intangible, and how to enable them for the practice of the analogy, considering that analogies can only be developed from what is known.
6.1 Limitations and continuity of the study
The evolution of the 155 families of products and services developed by the 46 entrepreneurs interviewed led to some perceptions that we cannot affirm because of the limitation of the sample size, but which we believe deserve further future research in terms of sampling. We would highlight three of our perceptions:

1. The more experienced the entrepreneur and the number of assets available, the greater the likelihood of exaptation. Here we start from the premise that experienced entrepreneurs have had contact with a greater number and diversity of entities which might offer opportunities for exaptation. This is consistent with prior work on entrepreneurial bricolage which suggests that the larger the “trove” or set of accumulated odds and ends, s/he possess the broader the range of problems s/he can address (Baker and Nelson, 2005; Stinchfield et al., 2013).

2. The exaptation mechanism is characterized as more likely to be a one-off or rare event in comparison with other creation mechanisms.

3. The more wide-ranging and complex the organizational entity, the more difficult it will be to exapt it, making, for instance, the exaptation of the process entity more difficult than the skill or tacit knowledge entity.

References


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Appendix 1

Figure A1. Algorithm for analyzing the exaptation mechanism
Appendix 2
Other creation mechanisms addressed in the interviews with the entrepreneurs:

- **Adaptation.** Unlike exaptation, where function follows form, in adaptation a form follows function. In other words, the form of the entity is altered to deliver the same function to customers with the same demand (Andriani and Cattani, 2016). In adaptation, the focus is on the pre-existing fitness function (Andriani et al., 2015). According to Dew et al. (2004, p. 72) adaptation “is actually better described by the term “aptation” rather than adaptation, since the etymology of “aptus” is “fit”, whereas “adaptus” refers to the process of increasing fitness by designing for a particular function”.

- **Copy.** Entrepreneurial copycats are those that begin a business with routines, competences, products and services that vary minimally in a particular market (Koellinger, 2008). Copying can occur in different ways, for example, by applying reverse engineering.

- **Frugal innovation.** Act of excluding non-essential functions that existed in the original product or service and/or replacing parts with cheaper analogous parts (Sarkar, 2011) to meet the needs of consumers with low buying power in a previously discriminated and neglected market (Zeschky et al., 2011).

- **Improvement.** Actions of improvement are intended to make something that already exists better and basically continue doing what it does, only more efficiently, more quickly, at a lower cost, better functions and more accurately, [...] (Tidd et al., 2005).

- **New Combination.** A subclass of NPD is new combination, as proposed by Villani et al. (2007). In this way of framing NPD, the new product or service results from the integration of technological elements or processes that already existed previously. However, they were originally conceived and developed by different entrepreneurs. In this creation mechanism, the entrepreneur operates more as an integrator of already existing entities.

- **New Product Development (NPD).** This mechanism involves activities distributed over three stages: predevelopment stage, development stage, commercialization stage (Langerak et al., 2007). The resulting product or service “can be new to the business, new to the market, or new to the world”. In other words, there is no need to be something new to the market and the world (Najafi-Tavani et al., 2013, p. 3397). The aspect to highlight is that NPD results in something new at least to the one who develops it, in the context of this study, the entrepreneur.

- **Nonaptation Junk.** Also known as technological nonaption, it is characterized as unexpected results obtained through technological research, often associated with new product development (NPD). Innovations based on nonaptation junk make use of inputs described as “materials and knowledge that just lies around” (Garud et al., 2016, p. 152). The best-known case is the experiment conducted at 3M that resulted in a “glue that did not glue”, which was later recovered and constituted the Post-it note.

- **Nonaptation Spandrels.** Creation using a resource hitherto without use, in other words not (from the Latin non) or without aptation. Gould (1997) adopted the term spandrel from architecture to illustrate how an empty space, initially without use in buildings, was later filled with mosaics and paintings and came to have an important esthetic function in buildings (Villani et al., 2007). The prototypical example presented by Gould (1997) is Saint Mark’s cathedral in Venice, whose domes were built three centuries before the mosaics that now adorn them (Garud et al., 2016).
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<thead>
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<th>Entity</th>
<th>Context</th>
<th>Comments on the case</th>
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<tbody>
<tr>
<td>Moving assembly line (Mastrogiorgio and Gilsing, 2016)</td>
<td>Initial function (original)</td>
<td>Ford became aware of the moving assembly line used in the meatpacking industry in Chicago</td>
</tr>
<tr>
<td></td>
<td>Final function (exaptated)</td>
<td>Analogously, Ford adopted the moving assembly line to make cars</td>
</tr>
<tr>
<td>Printed text (Bonifati, 2012)</td>
<td></td>
<td>Until then, Ford had deep experience in handcrafting a car (static car in the garage) but no experience with a moving assembly line</td>
</tr>
<tr>
<td>Programmable calculator (Entrepreneur #2)</td>
<td></td>
<td>In the 1490s, the Dominican friar, Girolamo Savonarola (1452–1498) used printing to divulge his verbal sermons that contained strong criticism of the morality of the church</td>
</tr>
<tr>
<td>Resource for decorating environments for work on landscaping (Entrepreneur #10)</td>
<td></td>
<td>Entrepreneur #2 held programming courses for programmable calculators (HP 48 Series) and perceived the opportunity to create layers of internal software for the calculator, transforming it into a data collector focusing on mobile computation demands, as in the case of orders in restaurants and the reading of water and electricity consumption for utility companies</td>
</tr>
</tbody>
</table>

Entrepreneur #2 used the programmable calculator to give programming classes to engineering students and professionals.Entrepreneur #2 used the programmable calculator to collect data to record orders in a restaurant and for electricity and water consumption in buildings.

Entrepreneur #10, architect and provider of projection and execution services for landscaping.

Entrepreneur #10 used vases for plants in the landscaping environments that he develops.

Entrepreneur #10 used vases to return water from a hydraulic pump installed in a lake projected by him in a landscape.

Entrepreneur #10 used the vase to give an effect of a pot that gushes water endlessly. The return from the water circulation pump in the lake pours the water into a vase that is slightly tilted with the lip pouring water into the water mirror. (continued)
<table>
<thead>
<tr>
<th>Entity</th>
<th>Type</th>
<th>Agent</th>
<th>Initial function (original)</th>
<th>Final function (exaptated)</th>
<th>Comments on the case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource used in intestine surgeries</td>
<td>Material input</td>
<td>Entrepreneur #83, veterinary surgeon with a clinic to treat pets</td>
<td>Entrepreneur #83 used cannelloni for feeding purposes</td>
<td>Entrepreneur #83 began to use cannelloni as an instrument to support the suture of two parts of the intestine of a pet after a piece is removed</td>
<td>Entrepreneur #83 noted that cannelloni, as it is internally drained and has different dimensions, could be used to support for the suture and hold together the two emended parts of the intestine in the early healing until the cannelloni is absorbed by the intestine itself</td>
</tr>
<tr>
<td>Neuro-functional reorganization</td>
<td>Technique</td>
<td>Entrepreneur #56, speech therapist with a speech therapy clinic</td>
<td>Entrepreneur #56 applied a technique to stimulate the central nervous system to treat patients with autism</td>
<td>Entrepreneur #56 applied the same technique to help children with urinary incontinence</td>
<td>Entrepreneur #56 serves a wide variety of customers at his speech therapy clinic. He discovered that the technique used to treat autistic patients could also help children with incontinence. A speech therapist would normally not provide this kind of treatment, but the principle is the same. Some synapses that were not established in infancy are reviewed with various repetitive exercises to help mature the part that was not stimulated until the child has control over the muscle that controls the urinary function</td>
</tr>
<tr>
<td>Entity</td>
<td>Name (source)</td>
<td>Type</td>
<td>Agent</td>
<td>Initial function (original)</td>
<td>Final function (exaptated)</td>
</tr>
<tr>
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<td>-------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Stimulus for corporate innovation (Entrepreneur #50)</td>
<td>Technique</td>
<td>Entrepreneur #50, engineer and specialist in innovation</td>
<td>Entrepreneur #50 conceptualized and presented practical examples of a technique for the development of innovative teams on an MBA program for executives</td>
<td>Entrepreneur #50 applied the technique to consultancy work in companies to help implement corporate innovation programs</td>
<td>After an MBA class, a student of Entrepreneur #50 invited him to hold a consultancy in his company, a corporate innovation program in which he applied the method taught in the MBA classes. Ever since, the engineer has also worked as a consultant</td>
</tr>
<tr>
<td>Psychopedagogical diagnosis (Entrepreneur #41)</td>
<td>Technique</td>
<td>Entrepreneur #41, psychopedagogue with a psychopedagogy clinic</td>
<td>Entrepreneur #41 applied a technique to identify children’s difficulties in learning school subjects, including behavioral disturbances and interpersonal relationship problems</td>
<td>Entrepreneur #41 applied the technique to identify the potential careers of teenagers</td>
<td>Entrepreneur #41 always worked children with learning difficulties and their families. In these sessions, she noted that the diagnostic tests did not only identify children’s difficulties, but also their facilities and innate competences. She noted that the children demonstrated skills and competences of their own for certain types of profession and began to orient the parents in this sense. Soon, the parents of teenagers were seeking her to help their children when they were in doubt over their career choice</td>
</tr>
</tbody>
</table>
Design-driven innovation: a systematic literature review

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Abstract
Purpose – The concept design-driven innovation focuses on innovating product meanings. It has been studied from a variety of perspectives and contexts since the early 2000s. However, a complete overview of the literature published in this area is currently missing. The purpose of this study is to provide a comprehensive understanding of how design-driven innovation contributes to value creation in product development.

Design/methodology/approach – In this systematic literature review, 57 papers and book chapters that cover design-driven innovation were identified and analyzed. An iterative coding process was followed to derive five facets of design-driven innovation that contribute to value creation.

Findings – Design-driven innovation creates value by focusing on the intangible values of products. The following five facets of design-driven innovation that contribute to value creation were identified: development of new product meanings, knowledge generation, actors and collaborations, capabilities and process. These facets and their interrelations are presented in a theoretical framework.

Practical implications – The main practical implication of this study is that it is now clear that the five facets of design-driven innovation are interrelated and reinforce each other. Therefore, companies need to approach design-driven innovation from a holistic perspective.

Originality/value – This paper contributes to theory by presenting the theoretical framework that provides an overview of available knowledge and that creates a context for future research.

Keywords Systematic literature review, Value creation, Design-driven innovation, Product meaning

Paper type Literature review

1. Introduction
The potential positive impact of design on competitive advantage has been discussed since the 1980s. Where earlier examples focus on the contribution of design to product appearance and styling (Kotler and Rath, 1984; Ravasi and Lojacono, 2005), newer examples illustrate the contribution of design to problem solving and innovation (Schneider, 1989). Since then, using design to solve complex problems, often referred to as design thinking, has increased in popularity. The role of design in design thinking is often discussed with a user-centered (or consumer-centered) perspective (Kimbell, 2011). However, critics argue that this narrow interpretation of design does not completely cover the role design plays in innovation (Jahnke and Johansson-Sköldberg, 2014). An additional argument to broaden the horizon is that consumers also seek delight and new meaning in their lives (Oberg and Verganti, 2014). This is not necessarily a new idea, since Levy already argued in the late 1950s that
consumers buy products for what they mean to them, in addition to their functionality (Levy, 1959). This understanding was later reiterated in other frameworks. For example, Christensen’s theory on “jobs to be done” advocates that a “job” (that what the user/consumer aims to achieve) also includes social and emotional factors (Christensen et al., 2016).

Adding to design and innovation theory, Verganti (2003) introduced the concept of design-driven innovation, which unlike previous frameworks explicitly concentrates on the innovation of product meanings. This provides an alternative strategy for companies to develop more valuable products. In design-driven innovation, the concept of product meaning refers to what values a product creates for a consumer, including utilitarian, emotional, psychological and socio-cultural values (Verganti, 2009). Therefore, design-driven innovation broadens the horizon beyond user-centered design and balances knowledge about user needs, technological development and product language. Design-driven innovation focuses on why consumers use a product, rather than what the product is or how it is used (Verganti and Ö berg, 2013). Examples of innovation of product meanings include Apple’s iPod and iTunes, which radically changed the buying experience of digital media and FIAT’s Panda, which changed consumers’ perception of low-end cars, from being a compromise to a fun product (Verganti, 2009).

Design-driven innovation has been studied in different industries and contexts and from various perspectives such as design practice (Jahnke and Johansson-Sköldberg, 2014), innovation strategy (Dell’Era and Verganti, 2009) and management (Cantarello et al., 2011). These studies provide insights into how design-driven innovation contributes to value creation in different fields. Overall, value creation could either refer to value created for a consumer or value created for a company (Smith and Colgate, 2007). Lepak et al. (2007) argue that value creation depends on the subjective judgment by the consumer on the new product’s value. This perceived value needs to result in a purchase where the price paid is higher than the company’s production costs. Furthermore, the perceived value of the product needs to be higher than available alternatives.

While there are literature reviews available on the broader topic of design thinking (D’Ippolito, 2014; Johansson-Sköldberg et al., 2013; Razzouk and Shute, 2012), a complete overview of previous research on design-driven innovation is currently missing. Therefore, this study aims to take a systematic look at published research and to provide a more comprehensive understanding of how design-driven innovation contributes to value creation. To delimitate this broad scope and to provide a focus, value creation discussed in this paper refers to the value a company creates for a consumer. Furthermore, this paper will focus on value creation through design-driven innovation in product development specifically. The following research questions are addressed in this study:

**RQ1.** What is the contribution of design-driven innovation to value creation?

**RQ2.** What are the facets of design-driven innovation that contribute to value creation in product development?

The remainder of this paper is structured as follows: First, the research method for this systematic literature review is described in Section 2. This is followed by the description and analysis of the selected literature in Sections 3 and 4. Then, the results are discussed in Section 5, which includes a discussion on both the theoretical and practical implications, the limitations of the study and suggestions for future research. In Section 6, the conclusions of this study are provided.
2. Research method

A systematic literature review was conducted by following four steps during the content analysis:

(1) material collection;
(2) descriptive analysis;
(3) category selection; and
(4) material evaluation (Seuring and Gold, 2012).

Each of these steps is described in further detail below.

2.1 Material collection

The literature on design-driven innovation and product meaning was collected through the databases Scopus and Web of Science in January 2016. These two concepts were determined after an experimental approach with various broader and narrower search terms. For example, a search on “design” AND “innovation” in the database Scopus led to 24,228 results. Given the aim to review the literature on design-driven innovation with a focus on product meaning innovation, these results were considered to be beyond the scope of this study. At the same time, a search on “design-driven innovation” AND “product meaning” in the database Scopus provided four results, which was too narrow to address the aim of this study. Table I provides an overview of the exact and final search terms and the delimitations of this literature review.

Initial searches generated a sample of 109 sources and two screening processes were conducted: an abstract review and a full paper review. Sources irrelevant to this study were excluded for further analysis. An additional step was added apart from collecting material through the databases. Sources that were referred to in three or more of the sources remaining in the sample after the second screening, and which referred to the identified categories (see Category selection below), were included for material evaluation (Table II). Including the sources gathered through this snowballing method, the final sample included 57 peer-reviewed journal articles and book chapters published between 1982 and 2015. The complete list of references included in the final sample is presented in Appendix 1.

2.2 Descriptive analysis

To create a context for the content analysis, an overview of the formal characteristics is provided (Seuring and Gold, 2012). For this literature review, the author(s), publication year, journal, category (empirical, theoretical, conceptual or popular scientific contribution), research methods, industry and region were documented. For each source the main field (e.g. design management or marketing) was documented as well. It should be noted that because most sources discuss multiple fields, only the predominant field was documented.

2.3 Category selection

Prior to material evaluation, initial categories for analysis and paper screening were selected. These were based on the aim and research questions formulated for this review. The following categories were chosen:

- definition of design-driven innovation;
- definition of product meaning;
- connection between design-driven innovation and product meaning;
<table>
<thead>
<tr>
<th>No.</th>
<th>Database</th>
<th>Search string</th>
<th>Search field</th>
<th>Delimitations</th>
<th>Date range</th>
<th>Language</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scopus</td>
<td>“Design-driven innovation” OR “Design driven innovation” OR “Product meaning”</td>
<td>Article Title, Abstract, Keywords</td>
<td>Article or Review</td>
<td>All years to present</td>
<td>English</td>
<td>73</td>
</tr>
<tr>
<td>2</td>
<td>Scopus</td>
<td>(“Design-driven” OR “Design driven”) AND (“innovation”)</td>
<td>Article Title, Abstract, Keywords</td>
<td>Article or Review</td>
<td>All years to present</td>
<td>English</td>
<td>46 (28 duplicates, 18 new sources)</td>
</tr>
<tr>
<td>3</td>
<td>Web of Science</td>
<td>“Design-driven innovation” OR “Design driven innovation” OR “Product meaning”</td>
<td>Topic</td>
<td>Article</td>
<td>All years to present</td>
<td>English</td>
<td>36 (34 duplicates, 2 new sources)</td>
</tr>
<tr>
<td>4</td>
<td>Web of Science</td>
<td>“Design-driven” or “Design driven” AND “innovation” a</td>
<td>Topic</td>
<td>Article</td>
<td>All years to present</td>
<td>English</td>
<td>25 (9 duplicates, 16 new sources)</td>
</tr>
</tbody>
</table>

*Initial sample 109*

**Notes:** This combination initially led to a broad range of papers which were not related to design-driven innovation. Therefore, this search was further delimitated. A table describing these delimitations can be found in Appendix B.
value of design-driven innovation;
role of design;
product development;
process;
actors;
context – when; and
context – where.

These categories were further refined and reformulated as described in Section 2.4. Sources that did not provide information on one of these categories, or which only included minimal information about one or two of these categories were excluded from further analysis (Table II).

2.4 Material evaluation
The final sample was evaluated according to the three phases of qualitative analysis (Miles and Huberman, 1994): data reduction, data display and conclusion drawing. The first phase, data reduction, was already initiated during the step Category selection, where information related to the ten categories was gathered in a spreadsheet.

The data were further reduced and displayed in sub-categories through iterative coding cycles, during which the categories were inductively refined and specified (Seuring and Gold, 2012). In this process, codes were assigned to the data collected from each source within each category. Based on the codes, the collected data from different sources were gathered and compared during the phase data display. Through the process of coding and displaying the codes, the sub-categories that were discussed most frequently emerged. For example, the data gathered about product meaning were coded in the following sub-categories: intangible values, context dependency, product semantics, product language and others. These sub-categories were then interpreted and gathered as “characteristics of product meaning” and “communication of product meaning.”

Last, during the phase conclusion drawing,” the iterative process led to the identification of five facets of design-driven innovation that contribute to value creation. These facets were
displayed in a framework that provides an overview of the available knowledge on value creation through design-driven innovation in product development.

3. Descriptive analysis
This section presents the main formal characteristics of the final sample, creating a context for the qualitative description of the results presented in the following section.

3.1 Distribution of publications
The final sample included papers published between 1982 and 2015. Figure 1 shows the distribution of these papers over time. A distinction is made between sources that include a definition of design-driven innovation, product meaning, both concepts or neither of the concepts. The last category concerns sources that discuss these concepts without giving a clear definition. The results demonstrate that the concept of product meaning has been discussed longer and more frequently than design-driven innovation. The concept of design-driven innovation first showed up in 2003, when Verganti discussed the innovation of product language and product meaning in the Design Management Journal. This paper, along with Verganti’s book on design-driven innovation (2009), is one of the most frequently cited sources on this topic in this review.

3.2 Distribution of research fields
Design-driven innovation and product meaning have mainly been discussed in the field of design management, followed by marketing, design practice and innovation management (Figure 2). The category “Other” consists of fields that were only included once, such as industrial ecology and material design. Interesting to note is that all sources included in this category were published between 2010 and 2014. This indicates that design-driven innovation is starting to receive attention outside the traditional fields of design and innovation management.

The research has been published in a broad range of outlets and the final sample included two books, four book chapters and 38 academic journal publications.
3.3 Distribution of research categories
Most of the published research is empirical in nature (Figure 3). Therefore, the qualitative description of the results is mainly based on empirical findings. Out of the 33 empirical studies, 16 studies were case studies, some combined with additional methods. Of these 16 case studies, 10 were completely or partially conducted in Italy. In addition to that, six other types of studies were also conducted in Italy. This frequency could be explained due to the inclusion of multiple papers written by Dell’Era and Verganti, who were connected to Politecnico di Milano in Italy at the time of the literature search.

3.4 Distribution of studied industries
The research included in this review has been conducted in various industries, ranging from food and furniture to the automotive industry (Figure 4). In total, 20 studies focused on
multiple industries. This diversity also needs to be taken into consideration in the qualitative description of the results.

3.5 Distribution of studied countries
The research included in this review has been conducted in various countries, including countries from Europe, Asia and North America (Figure 5). In total, seven studies were conducted in multiple countries. However, most of the included sources do not specify where the empirical data is collected, or in case of theoretical studies, if the study is relevant to a specific country or region.
4. Content analysis
In this section, a synthesis of the qualitative data is presented. First, the definitions of design-driven innovation as discussed in literature are described, followed by a description of the discussed forms of value creation. Then, an overview of the following five facets of design-driven innovation that contribute to value creation in product development is given: development new product meanings, knowledge generation, actors and collaborations, capabilities and process. Last, a theoretical framework is proposed that includes these five facets and their interrelations.

4.1 Definition of design-driven innovation
The topics discussed in the literature regarding the definition of design-driven innovation are summarized in Table III. This table provides a complete overview of the references supporting the discussed topics.

Design-driven innovation is rooted in Krippendorff’s interpretation of design as a meaning-making activity (Johansson-Sköldberg et al., 2013). This is also demonstrated by the 12 sources included in this review that refer to Krippendorff’s definition of design. According to Krippendorff (1989, p. 9), “design is making sense (of things)” and he clarifies this by stating that “the products of design are to be understandable or meaningful to someone.” Referring to this interpretation of design, Verganti (2003, p. 36) defined design-driven innovation as “an innovation in which the novelty of a message and of a design language prevails over the novelty of functionality and technology.” The concept of product meaning was already included in 2003, but its role was emphasized later when Verganti (2008, p. 437) stated that several companies see design-driven innovation as “the radical innovation of a product’s meaning”.

In this review, 24 sources include one or more references to Verganti in their definition of design-driven innovation, not including the sources where he is listed as first author. However, these definitions are often not in the form of quotations and the authors highlight different aspects from previous literature, such as product semantics, emotional and symbolic content, the contrast to user-centered design, and technological development.

<table>
<thead>
<tr>
<th>Topic</th>
<th>References</th>
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</table>
4.2 Value creation through design-driven innovation

The topics discussed in the literature regarding the value of design-driven innovation are summarized in Table IV. This table provides a complete overview of the references supporting the discussed topics.

The value of design-driven innovation is difficult to quantify, as its benefits are often indirect (Jahnke and Johansson-Sköldberg, 2014). Nonetheless, various authors discuss the value of design-driven innovation to gain a competitive advantage (Gotzsch, 2006; Talke et al., 2009). Product differentiation is the competitive advantage that is discussed most frequently. Product differentiation refers to the degree to which products are clearly distinguished from competing products (Ravasi and Lojacono, 2005; Talke et al., 2009). Consumers are starting to give more attention to the intangible values and satisfactions of products (Dell’Era and Verganti, 2009; Dell’Era et al., 2011). Design-driven innovation as an enabler to product differentiation plays a role in both new and mature markets.

Focusing on new markets, Dell’Era et al. (2010) argue that simultaneous development of new technologies and new product meanings enables radical innovations. For example, technologies can support the expression of the intended product meaning by using new materials. They provide the example of the Nintendo Wii, as this radically innovative game console combined both new technologies and product meanings.

In mature markets, it is difficult for companies to compete solely based on functionality. Product features and functionalities are easily copied by competitors (Aaker, 2010), making the development of meaningful design more important (Gotzsch, 2006). The CEO of Intuit, Brad Smith, discusses how the company became too focused on features and functions over time. Focusing on the emotional aspects of their products enabled the company to attract new consumers (Smith, 2015).

The fact that product differentiation is based on emotional and symbolic values has a positive effect on product longevity, which is an additional competitive advantage. Product longevity concerns the long-term appeal of products to consumers, meaning that a product remains interesting, even after the initial novelty of the product has faded (Mugge et al., 2005; Verganti, 2009). As product features and functionalities are updated more often and quicker than product meanings, products that also address intangible values remain relevant to consumers for a longer period. This is also provided as one of the explanations to the prolonged popularity of FIAT’s Panda (Farhana and Bimenyimana, 2015; Verganti, 2009).

<table>
<thead>
<tr>
<th>Topic</th>
<th>References</th>
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</thead>
<tbody>
<tr>
<td>Mature markets</td>
<td>Gotzsch (2006) and Gotzsch et al. (2006)</td>
</tr>
</tbody>
</table>
4.3 Development new product meanings

The topics discussed in the literature regarding developing new product meanings are summarized in Table V. This table provides a complete overview of the references supporting the discussed topics.

Where design-driven innovation is generally described as the innovation of product meanings, there is less consensus concerning the concept of product meanings itself. Even though researchers seem to agree that the value of a product includes more than its features and functionalities, discussions regarding this topic are scattered. According to Krippendorff (1989, p. 12) “meaning is a cognitively constructed relationship. It selectively connects features of an object and features of its (real environment or imagined) context into a coherent unity.” Thus, whether the consumer is aware of it or not, products are always given a meaning. However, product meanings are not concrete and are difficult to quantify (Rampino, 2011). The concept is further defined through its characteristics and construction.

The first characteristic of product meanings is that they are context dependent (Krippendorff, 1989; Helfenstein, 2012). As an example, Karana (2009) explains that consumers give different meanings to a teapot depending on whether it is placed in our kitchen, an antique shop, or other contexts. Second, product meanings are dynamic. Product meanings change over time as both contexts and consumers’ goals continuously evolve (Ligas, 2000). Another characteristic of product meanings is that they are concerned with intangible attributes, such as emotional and socio-cultural needs (Hirschman, 1982). It is not

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<th>Dimension</th>
<th>Topic</th>
<th>References</th>
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Table V.
Developing new product meanings
a given that these intangible values are discussed during product development. However, due to the increased importance of these aspects, it is relevant that they are made explicit (Gotzsch, 2006).

Other authors have focused more on how product meanings are constructed and communicated to consumers. First, as product meanings are context-dependent, the creation of new meanings requires knowledge about changes in socio-cultural contexts, as is discussed further in the next section. The appearance of a product is used to communicate new meanings. For example, the ease of use and conceptual novelty of Apple’s Macintosh was expressed through color, form and surface (Battistella et al., 2012; Ravasi and Lojaco, 2005). The literature includes different aspects of the relation between product appearance and meaning. The three main subjects discussed are:

1. product semantics, the study of symbolic and communicative qualities of objects in their context of use (Krippendorff and Butter, 1984);
2. product language, “a set of signs, symbols and icons” that communicate a message (Verganti, 2003); and
3. semiotics, the signs that create a product language, including for example form, color and sound (Monó, 2004).

4.4 Knowledge generation for design-driven innovation
The topics discussed in the literature regarding knowledge generation for design-driven innovation are summarized in Table VI. This table provides a complete overview of the references supporting the discussed topics.

As stated above, the development of new product meanings requires knowledge about changes in socio-cultural contexts. This concerns changes to social and cultural values that are inherent to a context. It includes for example the importance of gender equality, or the role of clothing to convey social norms (Jahnke and Johansson-Sköldberg, 2014). This knowledge is tacit, distributed and can be acquired through a research process and discussed with “key interpreters” (Section 4.5). This research process is focused on the exploration of new product meanings and languages (Verganti, 2008). In addition to this, technological knowledge is needed, as understanding of new materials and technologies enables the development of new product meanings (Dell’Era et al., 2010; Goto and Ishida, 2014).

Last, companies need to generate knowledge on how consumers give meaning to products (Helfenstein, 2012). Product meanings cannot be dictated by the company, because they are influenced by the cognitive schemes of consumers that organize and interpret the

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value of the product (Bellini et al., 2012). Therefore, design-driven innovation requires a second-order understanding. This means that designers need to understand how other people perceive product meanings (Krippendorff, 2011). This makes it possible for designers to translate and transform new product meanings into products that consumers will understand (Bellini et al., 2012). Note that this is distinct from user-centered design, which is focused on understanding and fulfilling user needs (Verganti, 2008).

4.5 Actors and collaborations in design-driven innovation

The topics discussed in the literature regarding actors and collaborations in design-driven innovation are summarized in Table VII. This table provides a complete overview of the references supporting the discussed topics.

Various authors discuss the value of collaborations with different actors, also referred to as ‘key interpreters’. This includes several combinations of, and references to, the actors discussed by Verganti (2008, pp. 444-445). These actors include: firms in other industries, product designers, architects, magazines and other media, suppliers of raw materials, universities and design schools, showroom and exhibition designers and artists (Battistella et al., 2012; Cantarello et al., 2011). The role of the actors is to contribute with knowledge regarding changes in socio-cultural contexts and new product meanings (Verganti, 2008). Ideally, the actors are not part of the company’s industry and context, avoiding the possibility to be hindered by preconceived ideas (Öberg and Verganti, 2014).

The role of flexible supply networks and suppliers of new technology is explored further. Suppliers with the capabilities to work with new materials and technologies enable the expression of the intended product meaning (Cantarello et al., 2011; Dell’Era et al., 2010). However, apart from descriptions provided by Verganti (2009, pp. 120-133), little is studied and discussed in detail about the contribution of each of the other actors involved during design-driven innovation.

4.6 Capabilities for design-driven innovation

The topics discussed in the literature regarding capabilities for design-driven innovation are summarized in Table VIII. This table provides a complete overview of the references supporting the discussed topics.

Design-driven innovation requires other capabilities from companies compared to other innovation processes (Jahnke and Johansson-Sköldberg, 2014; Verganti, 2008). First, it requires the capability to interpret changes in socio-cultural contexts (referred to as “Interpretation” in Table VIII). The capability to interpret refers to recognizing and understanding changes in socio-cultural contexts and to influence these contexts by proposing new product meanings. To acquire this, it is important that companies build

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relationships with key interpreters (Verganti, 2008). Second, creative capabilities are required to give form to new product meanings and to address complex or conflicting challenges in the design process (Jahnke and Johansson-Sköldberg, 2014). Third, design-driven innovation requires dynamic capabilities. This concerns the companies’ ability to acquire and develop competences to address changing circumstances. This is required as design-driven innovation balances both the explorative and exploitative character of design (Cautela and Zurlo, 2012). Last, to support the distinct character of design-driven innovation, specific management capabilities need to be developed to support the process of meaning-making (Jahnke and Johansson-Sköldberg, 2014).

4.7 Process for design-driven innovation
The topics discussed in the literature regarding process for design-driven innovation are summarized in Table IX. This table provides a complete overview of the references supporting the discussed topics.

In general, the reviewed literature did not focus on the process, process phases or actions for design-driven innovation. Little consensus was found among the authors on this subject. According to Verganti (2008), the process of design-driven innovation is not formalized and it is difficult to grasp applying research methods from product development. He stresses that the process does not start with an insight on the needs of a consumer, rather it starts from an insight on new product meanings. He has identified three main activities of design-driven innovation: listening, interpreting and addressing (Verganti, 2009).

Making the connection to product development, Dell’Era et al. (2008) have identified a so-called metaproject, which occurs prior to product development. Within this project, collaborations among actors are established and changes in socio-cultural contexts are researched. The process that follows is not divided in clearly defined phases (Dell’Era and Verganti, 2009), as it is a

<table>
<thead>
<tr>
<th>Topic</th>
<th>References</th>
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<tbody>
<tr>
<td>Dynamic capabilities</td>
<td>Bellini et al. (2012) and Cautela and Zurlo (2012)</td>
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Table VIII. Capabilities for design-driven innovation

<table>
<thead>
<tr>
<th>Topic</th>
<th>References</th>
</tr>
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<tbody>
<tr>
<td>Iterative process</td>
<td>Bellini et al. (2012), Jahnke and Johansson-Sköldberg (2014) and Verganti and Oberg (2013)</td>
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Table IX. Process for design-driven innovation
4.8 Theoretical framework

The connections between the five facets of design-driven innovation that contribute to value creation in product development are presented in the following theoretical framework (Figure 6). In this framework, design-driven innovation is defined as the innovation of product meaning. The development of new product meanings is guided by the generation of new knowledge on socio-cultural contexts, technological development and consumers’ interpretations. This knowledge is acquired through collaborations with a broad network of actors, who also contribute to the development of new product meanings. These activities are enabled through four capabilities: interpretation, creative capability, dynamic capability, and management capability.
and management capability. Last, these activities and capabilities are integrated in an iterative process, which results in new product meanings.

5. Discussion
The aim of this study has been to systematically look at published research on design-driven innovation to better understand its contribution to value creation in product development. The results provide insights on how design-driven innovation contributes to value creation. Furthermore, the specific facets that enable value creation have been identified.

5.1 The five facets of design-driven innovation
Design-driven innovation takes into account that all products have a meaning, whether this meaning is intentionally developed by a company or not. Consumers not only aim to satisfy their utilitarian needs but also attribute intangible values (e.g. emotional, social and cultural values) to products. Companies focused on design-driven innovation are not only aware of the fact that consumers attribute meanings to products, but they also make the intangible values that consumers seek concrete in the form of new products. Therefore, the results of design-driven innovation satisfy both utilitarian and intangible values.

The satisfaction of intangible values is becoming increasingly important in highly competitive markets where tangible features and functionalities are easily copied. The inclusion of intangible values enables product differentiation and contributes to the longevity of products. From this perspective, design-driven innovation contributes to value creation for both companies (improved competitive advantage) and consumers (addressed intangible needs).

Whereas this study has mainly focused on product development, other studies have shown that a better understanding and intentional inclusion of intangible values could result in better services (Beltagui et al., 2012) and in the development of more sustainable solutions (Aschehoug et al., 2013; Mugge et al., 2005). This indicates that the impact of design-driven innovation could be applied beyond the field of product development.

The following five facets of design-driven innovation that contribute to value creation in product development were brought forward in the reviewed literature: development new product meanings, knowledge generation, actors and collaborations, capabilities and process. The combination of these facets makes design-driven innovation distinct from other forms of innovation. For instance, research on actors and collaboration in design-driven innovation could be understood better by understanding the interrelations between these facets as presented in the theoretical framework.

5.2 Theoretical and practical implications
Previous literature reviews that cover design thinking have increased the understanding of researchers and practitioners of the concept. Although design-driven innovation has been identified as a popular direction within the broader field of design thinking (Johansson-Sköldberg et al., 2013), reviews on this specific topic are rare.

Previous research on design-driven innovation has commonly focused on separate aspects of product development. Although this contributes to gaining a more thorough understanding of each specific aspect, this research shows that these facets are not isolated. It is valuable to place this research on specific facets in a wider context of design-driven innovation. The theoretical framework integrates literature from various streams and presents how different facets of design-driven innovation interrelate. For example, research on actors and collaboration in design-driven innovation could be understood better by
pointing to the capabilities and processes through which these collaborations are enabled. Therefore, the theoretical framework presented here enables future researchers to focus on specific aspect, while being able to present it in a wider context. Furthermore, as the theoretical framework is based on literature from various streams, it enables researchers to connect their understanding of specific aspects of design-driven innovation to other areas. This contributes to a more in-depth understanding of design-driven innovation.

The presented theoretical framework has several practical implications as well. These are connected to the five facets of design-driven innovation. First, to increase value creation through design-driven innovation, companies need to acquire new knowledge. Companies need to expand their focus beyond a specific product or their own niche and seek for a wider variety of knowledge. To acquire this knowledge, companies need to initiate new collaborations with a broad network of actors, such as universities, artists or trend institutes. This also requires companies to develop the ability to communicate with different actors, some of which might not be familiar with product development or its jargon. Second, design-driven innovation builds upon certain capabilities which companies will need to develop and promote. Especially the capability to interpret changes in socio-cultural contexts and to develop new product meanings is central to design-driven innovation. Third, a design-driven innovation process is distinct from more linear and structured product development processes. Companies will need to be comfortable with the iterative process required to understand and develop new product meanings.

The last practical implication is founded in the interrelations of the five facets. Although it has been common in previous research to focus on each facet separately, the facets which have been identified contribute to and reinforce each other. For example, the development of new product meanings depends on new knowledge and its iterative process. This requires specific capabilities of the company to interpret this knowledge and to manage a non-linear process. Therefore, it is important that companies consider all facets and approach design-driven innovation from a holistic perspective.

6. Concluding remarks
6.1 Conclusion and contribution
This paper has presented a systematic literature review on the contribution of design-driven innovation to value creation in product development. In this review, five facets of design-driven innovation that contribute to value creation have been identified. These facets, as well as their interrelations, have been presented in a theoretical framework.

This study has contributed to theory by presenting a systematic overview on available knowledge. This provides a background for future research and enables the identification of research gaps, some of which have been suggested in this paper. Furthermore, the theoretical framework creates a context for future research. It enables detailed studies (e.g. on actors and collaborations) to be discussed in relation to the other facets of design-driven innovation.

The main practical implication of this study is found in the interrelations between the five facets of design-driven innovation. As the facets support and reinforce each other, it is important that companies approach these facets from a holistic perspective when striving to increase value creation through design-driven innovation.

6.2 Limitations and further research
Even though a large part of the reviewed literature consisted of empirical studies, this review and its conclusions are theoretical in nature. The theoretical framework needs to be studied and grounded in empirical research to increase its validity.
It should be stressed that the five facets of design-driven innovation that contribute to value creation in product development are theorized from a company perspective. The intangible values that consumers attribute to products have not been discussed in detail in the reviewed literature. In other words, the theoretical framework presents how companies intend to increase the value of the products they develop for consumers, and it does not include the actual value as perceived by consumers.

Furthermore, this study looks at value creation through design-driven innovation within the context of product development. It should be stressed that this is only one context that is influenced by a focus on innovating product meanings. Other contexts, such as business strategy, are omitted and could be explored further in future research.

An additional limitation is found in the early delimitation of the literature review to design-driven innovation and product meaning. It is plausible that other sources have discussed similar phenomena using different terminology. For example, later during the research, the term meaning innovation was identified, which refers to similar principles. However, these sources have not been identified within the limits of the applied search terms and could therefore not be included for analysis.

Concerning directions for further research, the literature review points to several research gaps that could be studied. First, the importance of collaborations with various actors is stressed in multiple studies, but only the role of supply networks is explored in more detail. The role of other actors needs to be studied further, as an increased understanding of their contribution to the development of new product meanings would benefit both theory and practice.

Second, most of the empirical studies included in this review were conducted at companies that already worked with design-driven innovation. Only the study by Jahnke and Johansson-Sköldberg (2014) is an exception. Therefore, little is known on if and how a company could change its innovation strategy to design-driven innovation. Future research could address this knowledge gap, for example through more action-oriented research approaches.

As discussed above, the sources included in this review focus on the perspective of a company. Little attention is devoted to the interpretations consumers actually give to new product meanings. Therefore, it is unknown if there is a discrepancy between the product meaning as intended by the company and the product meaning given by consumers. Future research could increase knowledge on the concept of second-order understanding. This would enable companies to better develop product meanings which are aligned with consumers’ interpretations.

Last, a sound definition on the concept of product meaning is missing. Due to its central role in defining and understanding design-driven innovation, the formulation of a concrete and cohesive definition has considerable value. Future research could take a multidisciplinary approach, gathering knowledge from fields as design, psychology and behavioral science, to better understand the intangible values consumers attribute to products and how this process takes place. Through generating and discussing this knowledge, the concept of product meaning could be refined, which would ultimately contribute to both the development of theory and to companies’ understanding of design-driven innovation.

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Appendix 1. Literature review sample


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Ethically questionable negotiation tactics in the Austrian workplace

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Abstract

Purpose – This study aims to generalize the research findings about the impact of individualism-collectivism, ethical idealism and inter-personal trust on ethically questionable negotiation tactics, such as pretending, deceiving and lying, in a Germanic culture, namely, that of Austria.

Design/methodology/approach – Survey questionnaires translated from English to German were collected from 304 respondents. A regression analysis was used to test the contribution of the independent variables to the explanation of negotiators’ attitudes towards questionable negotiation tactics.

Findings – The research empirically corroborated a classification of three groups of negotiation tactics, namely, pretending, deceiving and lying, in Austria. Austrian negotiators who scored high on vertical individualism tended to score high on the endorsement of the pretending tactic; those who scored high on horizontal collectivism tended to score low on the endorsement of the deceiving and lying tactics; those who scored high on vertical collectivism tended to score high on the endorsement of the deceiving and lying tactics; and those who scored high on inter-personal trust tended to score low on the endorsement of the pretending negotiation tactic. Idealistic negotiators tended not to endorse the use of pretending, deceiving and lying negotiation tactics.

Research limitations/implications – The study investigated the respondents’ perceptions, rather than their actual negotiation behavior. Findings are limited to Germanic culture.

Practical implications – The study provides negotiators in Austria with a tool that has the potential to predict the extent to which Austrian negotiators would use various ethically questionable negotiation tactics.

Originality/value – This is the first study to present a model of the antecedents of negotiation tactics in a Germanic cultural context, where negotiation studies are limited. This study validates in Austria three questionable negotiation tactics groups of varying severity, which had previously been studied only in non-Germanic cultures. This research significantly contributes to the generalization of a model of the antecedents of the endorsement of questionable tactics across cultures.

Keywords Individualism, Austria, Interpersonal trust, Collectivism, Negotiation tactics, Ethical idealism

Paper type Research paper

1. Introduction

Scholars believe that negotiation behavior is culturally bound (Ghauri et al., 1996). Several researchers have tried to find common denominators to negotiation behavior across cultures (Lewicki and Robinson, 1998; Robinson et al., 2000). The purpose of this study is to

The authors would like to thank two anonymous reviewers for their valuable comments on an earlier draft of this paper.
empirically examine relationships between cultural attitudes, namely, horizontal and vertical individualism-collectivism, as well as individual attributes, such as ethical idealism and interpersonal trust, and attitudes towards ethically questionable negotiation tactics (Erkus and Banai, 2011; Stefanidis et al., 2013; Banai, et al., 2014; Stefanidis and Banai, 2014) in a Germanic cultural context, namely, that of Austria. Germanic culture has been identified by various studies (Ronen and Shenkar, 1985) as significantly differentiating from other cultures. Therefore, the validation of negotiation concepts and models that have been found to be valid in cultures, such as near-Eastern (e.g. Greek, Kyrgyz and Turkish), Latin American (e.g. Peru) and others (e.g. Israel), in a Germanic culture has the potential to contribute to the generalization of negotiation models across cultures and, consequently, strengthen these models’ predictive power. Additionally, the findings of this study have the potential to equip foreign, as well as local, executives with empirical knowledge about what they should expect in the negotiation process with Austrian negotiators, and what negotiation tactics to prepare to conclude the negotiation successfully.

Lewicki and Robinson (1998) and Robinson et al. (2000) classified negotiation tactics into the following five discreet groups: traditional competitive bargaining, attacking opponent’s network, false promises, misrepresentation, and inappropriate information gathering. In the literature, traditional competitive bargaining has been considered rather acceptable, whereas the other four tactics are referred to as ethically ambiguous (Al-Khatib et al., 2005; Al-Khatib et al., 2008). More specifically, certain negotiators consider it acceptable to pretend to be angry and to make high opening demands. In Lewicki and Robinson’s (1998) and Robinson et al.’s (2000) research, these tactics have been referred to as traditional competitive bargaining. In recent research studies (Banai, et al., 2014; Erkus and Banai, 2011; Stefanidis et al., 2013; Stefanidis and Banai, 2014) some of these tactics have been classified as “pretending”. Respectively, according to this literature, misrepresenting facts, paying members of other groups or faking friendship for information may be considered deceiving and lying tactics that are mostly unacceptable by negotiators.

In view of these assessments, in this research we investigate questionable negotiation tactics based on the previously proposed classification of ethically questionable tactics into three groups, namely, into pretending, deceiving and lying (Erkus and Banai, 2011; Stefanidis et al., 2013; Banai et al., 2014; Stefanidis and Banai, 2014). These three groups of tactics escalate in their severity from less to more socially acceptable. Further, they can serve better in cross-cultural negotiation studies, given that more specific and discrete tactics, such as the inappropriate information gathering, are culturally bound and, thus, can generate biases in non-US international research contexts (Stefanidis et al., 2013).

The tendency to endorse the use of questionable negotiation tactics has been reported to be influenced by individuals’ levels of vertical and horizontal individualism-collectivism in Turkey (Erkus and Banai, 2011), in Peru (Stefanidis et al., 2013) in Israel and Kyrgyzstan (Banai et al., 2014) and in Greece (Stefanidis and Banai, 2014). These cultural milieus are considerably different from the Germanic context of Austria. The validation of previous studies’ classification of questionable negotiation tactics into three groups, namely, pretending, deceiving and lying, in Austria, has the potential to generalize this classification cross-culturally. Furthermore, although current literature has been increasingly assessing the ethicality of negotiation strategies in non-Western cultural contexts (Xiao and Ma, 2015; Yang et al., 2017), ethically questionable negotiation tactics within Germanic contexts have been largely unexplored. Therefore, research outcomes regarding negotiation tactics in Austria may extend existing intra-cultural and inter-cultural research, generating valuable conclusions for both theory and practice.
A similar argument could be made regarding the selection of antecedents of questionable negotiation tactics. Extending findings generated in non-Germanic cultures to that of Austria has the potential to generalize theory to Germanic contexts, such as those of Austria, Germany and Switzerland, and probably to other European cultures whose language is based on German, such as those of The Netherlands and Denmark (Encyclopedia Britannica, 2010). Three of the most significant antecedents of the endorsement of questionable negotiation tactics by negotiators, as proposed by current literature, have been culture (Triandis et al., 2001), ethical idealism (Forsyth, 1980), and interpersonal trust (Bazerman and Neale, 1992).

Culture, a factor that influences values, thoughts, behaviors and approaches of negotiators, is considered as one of the essential variables that directs the negotiation process (Cohen, 1993; Lin and Miller, 2003). Several studies show that individuals express different attitudes towards ethical behavior in negotiations and some of those differences are triggered by culture (Ma, 2010; Ma et al., 2013; Triandis et al., 2001; Volkema, 1998; Volkema and Fleury, 2002; Volkema, 2004; Zarkada-Fraser and Fraser, 2001). Following Triandis et al.’s (2001) suggestion, in this study, we measure cultural dimensions at the individual level to examine their impact on negotiators’ attitudes towards questionable negotiation tactics.

Besides individualism-collectivism, negotiators’ personal attributes have been associated with the endorsement of ethically questionable negotiation tactics (Volkema, 2004). Previously adopted approaches that test influences on negotiators’ behavior have included variables, such as demographics (Lewicki and Robinson, 1998; Kronzon and Darley, 1999; Ma, 2010; Ma et al., 2013; Volkema, 2004), personality (Ma, 2005), conflict type (Ma, 2007; Ma, 2010), ethical ideology (Al-Khatib et al., 2005, 2008), trust (Elahee et al., 2002) and emotional intelligence (Foo et al., 2004). Of the individual attributes recommended by research, we included the variables of ethical ideology and interpersonal trust that, according to the literature (Erkus and Banai, 2011; Stefanidis et al., 2013; Banai et al., 2014; Stefanidis and Banai, 2014), appear to be most relevant to our research of unethical negotiation tactics.

We use two sets of studies to generate hypotheses about the tendency of Austrian negotiators to endorse questionable negotiation tactics. The first set is a collection of data generated by studies that investigated general attitudes of Austrian respondents towards conflict management. The second set is a summary of findings of research that focuses specifically on attitudes towards questionable negotiation tactics in non-Germanic cultures. These two sets of studies are presented in the following section.

2. Theoretical framework and hypotheses development

2.1 Negotiation in Austria

Research findings about negotiation in Austria are limited and mostly focus on conflict management styles and negotiation management. In her qualitative study, Lichtblau (2001) interviewed 21 Austrian managers who worked in France. She concluded that Austrian managers tended to express their opinion, to actively participate in the decision-making process, and to adopt rather direct negotiation approaches. Meierewert and Horváth-Topcu (2001) arrived at a similar conclusion, describing Austrians as rather self-contained and direct in communication.

In her comparative study about managing multinational teams, Meierewert (2009) conducted 102 qualitative interviews with Austrian, Slovenian and Croatian team members, and found that Austrians were more task-orientated and less people-oriented. The Austrian managers communicated more directly, used flatter hierarchies, and presented a higher degree of self-responsibility than their Slovenian and Croatian team members. Additionally,
they preferred conflict resolution over conflict enhancement, and formulated their interpersonal conflict critique in a rather direct way. Valtingojer (2001), who interviewed 20 Austrians and 20 Italians, discovered that after the introduction of a first name salutation between the negotiating parties, the Austrians presented higher willingness to deviate from their working procedure and to talk about personal issues than their Italian peers.

Austrian negotiators often follow a carefully planned and methodical approach in gathering information and preparing for negotiation (Katz, 2007). They display strong aspirations for harmony (accommodation) in conflict situations and they tend to use “avoiding” conflict styles (Brück, 2001). In Krispler’s (2009) study, the 125 Austrian respondents tended to select a compromise approach in conflict situations, while, when they wanted to assert their interests, they tended to select a competitive approach. Yet, a collaborative approach was also used at times.

Pump’s study (2008) of 36 young university graduates indicated that the most frequently used conflict management style, endorsed by 55.6 per cent of the respondents, was “cooperation”. The “compromising” style was endorsed by only a few (8.3 per cent), and the least preferred conflict management style was the “avoiding” style (2.8 per cent). Pump’s (2008) survey of leaders of large Austrian companies (n = 69) reported similar results: the ‘cooperation’ style (55.1 per cent) was most frequently endorsed, the ‘compromising’ style was endorsed less (27.5 per cent), and the “avoiding” style (1.4 per cent) was the least preferred one. Additionally, a positive and significant correlation was found between “collaboration” and positive attitudes towards conflict resolution.

Fischer and Erten-Buch and Fischer (2001) interviewed 28 Austrian expatriates in England and found that they possessed a slower, less focus-oriented and less decision-driven negotiation approach than their British colleagues. Katz (2007) concluded that Austrian managers avoid aggressive or adversarial techniques due to their dislike of open confrontation and only infrequently tend to apply unethical behavior in negotiation. He found that Austrians rarely used deceptive negotiation techniques, such as “sending fake non-verbal messages”, “making false demands and concessions”, “telling lies” or “pretending to be disinterested in the whole deal or in a single concession”. In the next sections, we describe current knowledge about the dependent variable of ethically questionable negotiation tactics, and the independent variables of vertical and horizontal individualism-collectivism, ethical idealism and interpersonal trust. We then investigate relationships among those variables and we formulate hypotheses.

2.2 Ethically questionable negotiation tactics

“Negotiation is a process where two parties with differences, which they need to resolve, are trying to reach agreement through exploring for options and exchanging offers – and an agreement” (Fells, 2012). Many negotiation tactics are available to negotiators, some of which are considered ethically ambiguous or questionable. Most ethical issues in negotiation are concerned with truth telling (Lewicki et al., 2010). The meaning of truth telling raises the question of what a truthful presentation is and how it should be implemented in negotiation. There is an on-going debate whether negotiators should refer to negotiation as a Poker card game, and feel free to bluff their way (Carr, 1968), or should treat the negotiation process as a fair game, where there are clear rules that should not be broken (Koehn, 1997). This debate is brought up to demonstrate that there is no agreement on the definition of questionable negotiation tactics, not alone, their measurement.

Regardless, it has been shown that the use of ethically questionable negotiation tactics has economic and social implications (Schroth, 2008), such as financial loss and jeopardizing of future business agreements. Additionally, questionable negotiation behaviors create...
problems in terms of public relations and image and result in trust loss between negotiators (Cramton and Dees, 1993). In the long-run, opposing negotiators may adopt more rigid attitudes in future negotiations, and, consequently, relationships can break down and future opportunities can be missed (Reitz et al., 1998).

Although the use of ethically questionable negotiation tactics may provide short-term positive results, extremely negative situations may also arise, especially when relationships break (Curhan et al., 2006). The fact that ethically questionable negotiation tactics cause negativity between parties makes it more difficult to jointly reach objectives. Once damaged, the trust between parties ends with suspicion (Tenbrunsel, 1998). Research conducted by Boles et al. (2000) reported that a negotiator who detects another party’s unethical behaviors would be less enthusiastic about the success of future negotiations.

Lewicki and Robinson (1998) and Robinson et al. (2000) classified ethically questionable negotiation tactics into five groups: traditional competitive bargaining, attacking opponent’s network, false promises, misrepresentation, and inappropriate information gathering. Some ethically questionable negotiation tactics are considered acceptable, while other types are considered unethical and seriously problematic among parties. For example, endearing one to the other party, pretending to be angry or happy, and making high opening demands may be perceived by some to be acceptable tactics. These tactics can be called traditional competitive bargaining or pretending. However, misrepresenting facts, paying members of the other group or faking friendship for information, may be considered bluffing, deceiving and lying tactics, and frequently may not be acceptable by negotiators.

The five discrete negotiation tactics identified by Lewicki and Robinson (1998), and Robinson et al. (2000) cannot benefit from a common denominator and hence cannot be ranked for their severity. Also, as they were developed and measured in the USA, we do not know if they are valid for other countries, such as Austria. So, rather than trying to confirm the existence of the five discrete groups of questionable negotiation tactics in Austria, this study follows on recent research (Erkus and Banai, 2011; Stefanidis et al., 2013; Banai et al., 2014; Stefanidis and Banai, 2014) and empirically classifies negotiation tactics into three new concepts, namely, pretending, deceiving and lying, that could be ranked according to their severity. The aforementioned studies have used the factor analysis statistical method to validate the “pretending”, “deceiving” and “lying” negotiation tactics in countries such as Greece (Stefanidis and Banai, 2014), Israel and Kyrgyzstan (Banai et al., 2014), Peru (Stefanidis et al., 2013) and Turkey (Erkus and Banai, 2011). Yet, we could not identify studies that have validated this classification in Germanic cultures. In the following section, we review the independent variables, namely, individual cultural attitudes, ethical propensity and interpersonal trust, starting with vertical and horizontal individualism and collectivism as representatives of cultural attitudes.

### 2.3 Horizontal and vertical individualism-collectivism

Existing literature highlights individualism-collectivism as one of the significant dimensions that influence business people’s attitudes towards questionable negotiation tactics. Collectivistic individuals tend to form groups and to develop mutual dependence in prioritizing group over personal objectives. For individualists, individual goals precede group goals and individual behaviors are prioritized over group’s norms (Triandis, 1995). According to Jackson (2001), for collectivists the nature of the relationship between individuals and organizations is based on obligation and moral duty, whereas for individualists, the self-interests and, probably, the calculative attitudes precede. Consequently, the selection and application of negotiation tactics may vary between collectivist and individualist negotiators.
Two different arguments exist concerning the rationale for the relationship between collectivism/individualism and ethical decision-making in negotiations. One argument suggests that individualists demonstrate more unethical behavior because of the dominance of self-interest (Al-Khatib et al., 2008; Banai et al., 2014). The second argument contends that, as collectivists tend to be more competitive towards non-member individuals or groups, they have a greater propensity to behave in ethically questionable ways (Triandis et al., 2001; Rivers and Lytle, 2007). Research findings provide support for both arguments (Volkema, 1998; Triandis et al., 2001; Elahee et al., 2002; Volkema, 2004).

Referring to the importance of culture in explaining ethical perceptions, Jackson (2001) contends that individualism-collectivism attributes can sufficiently explain basic differences, but not complex differences. Indeed, some researchers argued that the individualism-collectivism dimension is very wide and abstract, necessitating more detailed definitions (Brewer and Gardner, 1996; Chen et al., 1998). Consequently, Triandis (1995) argued that individualism-collectivism attributes should be examined under two dimensions, a vertical dimension related to equality and a horizontal dimension related to hierarchy. Having related the individualism-collectivism variable to Hofstede’s (1980) power distance dimension, Triandis et al. (2001) reclassified the dimension of individualism-collectivism into four dimensions: horizontal individualism, vertical individualism, horizontal collectivism and vertical collectivism. Triandis et al. (2001) suggested that those dimensions could be used at the individual level of analysis. In line with this recommendation, the present study explores the relationship between negotiators’ individual cultural disposition and their attitudes towards ethically questionable negotiation tactics.

Horizontal individualists emphasize independence and self-reliance, while they view status differences as less important (Triandis and Gelfand, 1998). According to the Berlin Corruption Index, the lowest levels of corruption are observed in societies of which members are predominantly horizontally individualistic (Triandis, 1995; Triandis et al., 2001). Volkema (2004) concluded that people in economically developed countries are more horizontally individualistic and that they do not endorse ethically questionable tactics at large. In their cross-cultural research, Triandis et al. (2001) argued that, in general, horizontal individualists tend not to endorse questionable behaviors.

In a recent empirical research, individualism-collectivism were found to be related to attitudes towards questionable negotiation tactics. Specifically, Turkish negotiators who scored high on horizontal individualism tended to score high on the endorsement of questionable negotiation tactics (Erkus and Banai, 2011). However, similar findings were not corroborated in other empirical studies (Stefanidis et al., 2013; Banai, et al., 2014; Stefanidis and Banai, 2014). In general, horizontal collectivists have been reported to make the least use of unethical tactics (Triandis et al., 2001). Based on past research about Austrian negotiators’ conflict management style and theory suggestions regarding the relationship between culture and the endorsement of questionable negotiation tactics, we offer the following hypotheses:

\[ H1. \] Austrian negotiators who score high on horizontal individualism tend to rate (a) pretending, (b) deceiving and (c) lying negotiation tactics as less appropriate than those who score low on horizontal individualism.

For vertical individualists, diversity and status are important because individuals try to differentiate themselves from their counterparts (Triandis and Gelfand, 1998). Vertical individualists are competitive; they focus on maximization of their earnings and they try to perform better than others. However, research has shown that those who define themselves as aggressive and competitive tend to use ethically questionable negotiation tactics more
than cooperative individuals do (Lewicki and Robinson, 1998; Robinson et al., 2000). Vertical individualists use more competitive and dominating conflict management styles, and they tend to resort to ethically questionable negotiation tactics (Kaushal and Kwantes, 2006; Komarraju et al., 2008). In Peru (Stefanidis et al., 2013) and in Turkey (Erkus and Banai, 2011), vertically individualist negotiators have been found to endorse questionable negotiation tactics more than negotiators who scored low in vertical individualism. Hence, the following hypotheses are offered:

**H2.** Austrian negotiators who score high on vertical individualism tend to rate (a) pretending, (b) deceiving and (c) lying negotiation tactics as more appropriate than those who score low on vertical individualism.

Horizontal collectivists define themselves as part of a group and as equal to one another. Horizontal collectivists care to mutually establish good relations and to share objectives with their groups. Social compatibility and communication are important, so sharing is common (Triandis and Gelfand, 1998). For horizontal collectivists, cooperation is the foreground of the conflict resolution process, and the other parties’ needs are taken into consideration. Indeed, Komarraju et al. (2008) reported that horizontal collectivists prefer cooperative, accommodating, and compromising conflict management styles. Therefore, horizontal collectivists may avoid using ethically questionable tactics. Horizontal collectivist negotiators have been reported to endorse less deceiving and lying negotiation tactics in Peru (Stefanidis et al., 2013) and in Turkey (Erkus and Banai, 2011). The following hypotheses are offered:

**H3.** Austrian negotiators who score high on horizontal collectivism tend to rate (a) pretending, (b) deceiving and (c) lying negotiation tactics as less appropriate than those who score low on horizontal collectivism.

Vertical collectivists accept the notion that some group members are more important than others and individuals know their position in the hierarchy. To them, authority is unconditionally accepted and self-sacrifice for the group is regarded as valuable (Triandis and Gelfand, 1998). Triandis et al. (2001) suggested that most vertical collectivists would practice high levels of deceptive behavior in their negotiations. In their research conducted in eight different countries, Triandis et al. (2001) reported that, compared with horizontal individualists, vertical collectivists demonstrated more deceitful intention in negotiations. In particular, vertical collectivists have been reported to prefer the use of the avoiding negotiation style, not to care about long-term relationships and, thus, to be expected to use ethically questionable negotiation tactics (Kaushal and Kwantes, 2006). Vertical collectivists have been previously reported to endorse more questionable negotiation tactics in Peru (Stefanidis et al., 2013) and in Turkey (Erkus and Banai, 2011). Vertical collectivists were found to endorse deceiving and lying in both Israel and Kyrgyzstan (Banai et al., 2014). Thus, the following hypotheses are offered:

**H4.** Austrian negotiators who score high on vertical collectivism tend to rate (a) pretending, (b) deceiving and (c) lying negotiation tactics as more appropriate than those who score low on vertical collectivism.

### 2.4 Ethical idealism

One of the factors that affect individuals’ tactical negotiation choices is their ethical idealism. According to Ferrel et al. (1989), individuals’ moral philosophy approaches provide
standards directing judgments, actions and behaviors. As individual approaches concern wrong or right behaviors, ethical idealism can be considered a factor affecting the selection of a negotiator’s tactics.

Indeed, ethical negotiation behaviors related to culture, context and individual norms create ambiguity as to what behaviors and tactics are acceptable and thus make it hard to define rules and standards concerning ethical negotiation behaviors (Thompson, 2001). There are controversial views on this topic. For example, Lewicki et al. (2010) believe that ethical negotiation behaviors should be associated with generally accepting moral norms and ethical standards. Hitt (1990) argues that four approaches could be used to judge what behaviors are ethical in negotiations and business life. In this context, individuals concerned with their decisions’ results adopt the end-result ethical approach, while the community determines what is ethical under the social contract ethical approach. Individuals adopting rule ethics use predetermined rules and standards in making decisions, while under a personal ethics approach, it is the individuals’ mind and conscience that determine whether a behavior is ethical or not (Lewicki et al., 2010). Each criterion is based on different philosophies and value systems, and thus what behaviors in negotiations can be accepted as ethical vary depending on personal approaches.

Studying decision-making approaches, Forsyth (1980) classified individuals’ decision-making into two different ethical approaches. The first approach is idealism, where defined universal rules are valid for everyone and individuals make decisions in accordance with these rules. The second approach is universalism, where rules are rejected on the basis of relativism. Ethical decisions may vary according to individuals and situations. Research has shown a relationship between individuals’ levels of relativism or idealism and decisions concerning ethics. For example, a survey among managers (Vitell et al., 1993a) found that high-idealists tended to display higher levels of ethical behaviors and co-operation compared with those managers who scored low on idealism. Rawwas et al. (1995) also concluded that ethical ideology determined ethical decisions.

Variations in individuals’ ethical approaches can also be effective in ethical decisions in negotiations. Banas and Parks (2002) detected a significant relationship between ethical ideology and unethical behavior of individuals: high-idealist individuals regarded unethical behaviors to be less acceptable. In a study on negotiation among university students, Perry and Nixon (2005) reported that individuals accepting rule ethics (highly idealistic) adopted lower levels of unethical behavior.

Within the Turkish business context, Erkus and Banai (2011) discovered an inverse relationship between employees’ scores on ethical idealism and the endorsement of ethically questionable negotiation tactics. This inverse relationship has been proposed by other studies (Banai et al., 2014; Stefanidis and Banai, 2014). Al-Khatib et al. (2005) found a statistically significant negative relationship between idealism and unethical behavior. Aquino (1998) showed that employees’ high ethical standards decrease the use of deception. Krispler’s (2009) research in Austria concluded that individuals who generally adopt an unethical approach tend to endorse rather ethically questionable negotiation tactics. Hence, we hypothesize that:

H5. Austrian negotiators who score high on ethical idealism tend to rate (a) pretending, (b) deceiving and (c) lying negotiation tactics as less appropriate than those who score low on idealism.

2.5 Interpersonal trust
Another determinant variable of negotiators’ ethical behavior is trust, which can be defined as “confidence in the reliability of persons or things without careful investigation” (Landau,
1966, cited in Ross and LaCroix, 1996: 314), or as “an individual’s belief in and willingness to act on the words, actions and decisions of another” (McAllister, 1995: p.25). Trust is a function necessary for negotiations in business life (Bazerman and Neale, 1992) and it plays an important role in the negotiation process. Especially in negotiations of high risk and sensitivity, trust may enhance the quality of the negotiation’s results (Elahee et al., 2002).

Trust removes barriers and facilitates communication, creating a positive atmosphere and strengthening the relationship between the parties (Butler, 1995; Mayer et al., 1995; Ross and LaCroix, 1996; Elahee et al., 2002). Mutual trust between the negotiators can contribute to the creation of a suitable climate, the provision of more opportunities to consider other party’s needs and the mutual granting of concessions (Butler, 1999). In this context, individuals’ perceptions of trust in the selection of the negotiation tactics can be an effective research variable.

Research indicates that mutual trust in negotiation increases co-operative behavior and expedites information-sharing between parties (Butler, 1995, 1999). A study conducted by Mintu-Wimsatt et al. (2005) reported that interpersonal trust increased the problem-solving behavior in negotiations. Olekalns et al. (2007) found that mutual trust between negotiators increased earnings. A cross-cultural study conducted by Elahee et al. (2002) revealed that Mexican participants presented less trust in the foreign party in international negotiations. In their comparative research, Mintu-Wimsatt et al. (2005) found that American exporters acted more collaboratively under the condition of mutual trust, but similar results were not reported for exporters from the Philippines. According to Katz (2007), personal integrity and dependability are important to win Austrian negotiators’ trust. Indeed, although Austrians believe in the principle of “win-win”, they expect others to reciprocate their respect and trust (Katz, 2007).

Trust in negotiations also tends to reduce unethical behavior. In particular, Elahee et al. (2002) and Elahee and Brooks (2004) observed a significant negative relationship between trust and unethical behavior. Examining the relationship between trust and deception, Olekalns and Smith’s (2009) research detected that high emotional trust decreased deceptive behavior. Rotter (1980) argues that individuals who score high on trust propensity are less likely to lie and cheat. Hence, we offer the following hypotheses:

\[ \text{H6. Austrian negotiators who score high on trust tend to rate (a) pretending, (b) deceiving and (c) lying negotiation tactics as less appropriate than those who score low on trust.} \]

3. Method
We used self-administered questionnaires to investigate the effects of horizontal and vertical individualism-collectivism, interpersonal trust, and ethical idealism on attitudes towards ethically questionable negotiation tactics in Austria. To ensure reliability, the original English questionnaire was translated from English to German, and back-translated to English, by bilingual colleagues in Austria.

3.1 Participants and data collection
The participants were employees and lower-middle level managers working at various services, manufacturing and trade companies in the private sector. We randomly distributed the questionnaires to employees who had stated that they negotiated inter-organizationally (for trade, exchange or any other purpose). Business managers with work experience in
negotiation and business people who teach at two major Austrian universities helped us approach the potential participants. The data collection stage lasted 20 months. In total, 1,505 employees were invited to participate, of which 320 questionnaires were collected. The data screening stage provided a set of 304 usable responses, yielding an overall response rate of 20.19 per cent.

The respondents’ average age was 32.4 years (S.D. = 9.85); the median age was 30 years and the age range was 48 years. 68.4 per cent of the participants were male. 92.8 per cent of the respondents worked in the private sector, while 7.2 per cent worked in the public sector. German was the native language of the 96.4 per cent of the participants. Also, 72.7 per cent of the respondents had an A-levels degree, and 20 per cent had a university degree.

3.2 Measures
A survey questionnaire that included constructs adopted from other studies was compiled. The respondents were asked to think about a negotiation process they had taken part in over the past 12 months and to answer the questions as they might be related to their own negotiation. The research measures are described below.

3.2.1 Negotiation tactics. We decided to adopt seventeen questions based on the original ‘high ball’ tactics presented by Lewicki et al.’s (2010) and Fulmer et al.’s (2009) emotion management tactics scales, rather than use any of the scales that empirically classify items into a given number of factors based on a one-nation sample (Robinson et al., 2000). A seven-point Likert-type scale was used, where the responses ranged from 1 = strongly disagree to 7 = strongly agree. We instructed participants to rate an appropriate negotiation tactic for “something very important to them and their business.” Sample items from the used scale included: “In return for concessions from the other party now, offer to make future concessions that I know I will not follow through on” and “Get the other party to think that I like him/her personally despite the fact that I don’t really”.

To validate the structure of the construct, factor analysis with Varimax rotation was conducted. The three-factor solution that provided the best fit explained 58.60 per cent of the total variance. The first factor, named pretending, consisted of four items and explained 20.21 per cent of the variance. The second factor, named deceiving, included three items and explained 18.09 per cent of the variance. The third factor, named lying, included four items and explained 20.30 per cent of the variance. The Cronbach’s alpha coefficients of the three components were 0.72, 0.70 and 0.71, respectively. The factors structure and their items are presented in Table I.

3.2.2 Individualism-collectivism scale. A 32-item scale, designed by Singelis et al. (1995), was used to assess the participants’ individualist or collectivist orientation. A nine-point Likert-type scale was used; responses ranged from 1 = strongly disagree to 9 = strongly agree. This scale included four major dimensions that measured vertical individualism, horizontal individualism, vertical collectivism and horizontal collectivism. To validate the structure of the Individualism-Collectivism Scale, principal component factor analysis with Varimax rotation was conducted. The four distinct factors that derived accounted for 53.75 per cent of the variance: horizontal individualism had four items (e.g. “One should live one’s life independently of others”), and explained 11.58 per cent of the total variance; vertical individualism included four items (e.g. “Competition is the law of nature”) and explained 12.46 per cent of the total variance; horizontal collectivism had five items (e.g. “I feel good when I cooperate with others”) and explained 17.04 per cent of the total variance; and vertical collectivism encompassed four items (e.g. “I would do what would please my family, even if I detested that activity”) and explained 12.67 per cent of the total variance. The
Cronbach’s Alpha reliability coefficients for the respective factors were 0.64, 0.68, 0.79 and 0.70. Although some of the coefficient values are at the lower levels of being regarded as acceptable (George and Mallery, 2003), we deemed it appropriate to use the original structure of the measures of vertical and horizontal individualism and collectivism, because they are validated for the first time in an Austrian sample.

3.2.3 Ethical idealism. Participants’ ethical idealism was measured by six items adopted from the Ethics Position Questionnaire instrument (Forsyth, 1980). These items assessed the degree of idealism of the subjects (e.g. “The existence of potential harm to others is always wrong, irrespective of the benefits to be gained”). A five-point Likert scale that assessed the degree of idealism of the respondents was used (1 = strongly disagree, 5 = strongly agree). One factor that explained 52.63 per cent of the total variance was obtained. The Cronbach’s Alpha reliability coefficient of the scale was 0.82.

3.2.4 Trust propensity. Subjects’ general trust level was measured by eight items, adopted from Mayer and Davis (1999). A five-point Likert-type scale was used (1 = strongly disagree to 5 = strongly agree). The one-factor solution that included four items (e.g. “Most people can be counted on to do what they say they will do”) explained 46.75 per cent of the total variance. The Cronbach’s Alpha reliability coefficient of the scale was 0.62.
3.2.5 Control variables. Participants were asked to report a number of demographic characteristics, such as their industry of employment and their income. Four of these variables served as control variables: gender, age, hierarchical rank and education. Age and education were measured in years. Hierarchical rank within the organization was measured with the use of a ten-point scale (10 = the highest rank, 1 = the lowest rank).

4. Results
The means, standard deviations and correlations of the variables are presented in Table II. The table shows that the respondents endorsed more the pretending tactics (Mean = 4.32, SD = 1.18), followed by the deceiving (Mean = 3.50, SD = 1.29) and lying (Mean = 2.42, SD = 1.05) tactics.

Correlation analysis to examine the relationship between the independent variables and the ethically questionable negation tactics was performed. Hypotheses were tested using hierarchical regression analysis, where gender, age, rank and education were treated as control variables. Horizontal and vertical individualism-collectivism, ethical idealism, and trust were included as the independent variables in all three hierarchical regression models.

We reviewed the correlation coefficients between the independent variables (Hair et al., 1998) and we assessed the risk of multicollinearity among our independent variables using the tolerance and variance inflation factor (VIF) diagnostics. The VIF values were low (VIF < 1.13) for high levels of tolerance (Tolerance > 0.88).

The results of the hierarchical regression analysis on the pretending, deceiving and lying negotiation tactics are presented in Table III. The first step of the analysis provided a significant regression model (F = 15.15, p < 0.001) for the contribution of the independent variables to the explanation of the pretending tactics. A negative relationship between age (β = −0.42, p < 0.001) and the pretending negotiation tactics was found, explaining 16 per cent of total variance of the first-step model. The deriving model of the second step of the hierarchical regression was statistically significant (F = 13.53, p < 0.001). When the independent variables of vertical and horizontal collectivism-individualism, trust, and ethical idealism were included, the explained total variance increased from 16 per cent to 29 per cent. Vertical individualism (β = 0.20, p < 0.001) was positively associated with the use of pretending negotiation tactics, while trust propensity (β = −0.24, p < 0.001) and ethical idealism (β = −0.12, p < 0.05) were negatively associated with the endorsement of pretending negotiation tactics. Negotiators who scored high on trust propensity and on idealism tended to endorse pretending tactics less, while vertically individualistic negotiators tended to endorse pretending tactics more. Based on these results, H2a, H5a and H6a were supported.

The outcomes from the first step of the analysis of the contribution of the control variables to the explanation of the endorsement of the deceiving negotiation tactics provided a significant regression model (F = 6.19, p < 0.001). There was a negative relationship between age (β = −0.26, p < 0.001) and the endorsement of the deceiving negotiation tactics. Age explained 6 per cent of the total variance of the first-step regression model. The second-step hierarchical regression model was significant (F = 6.27, p < 0.001) as well, increasing the total variance explained from 6 per cent to 15 per cent. The coefficient of vertical collectivism was positive (β = 0.12, p < 0.05), while the coefficients of horizontal collectivism (β = −0.14, p < 0.05) and ethical idealism (β = −0.17, p < 0.01) were negative. Negotiators who scored high on vertical collectivism, tended to endorse deceiving negotiation tactics. Horizontally collectivistic and idealistic negotiators tended to endorse deceiving tactics less than the vertical collectivists did. Based on these findings, H3b, H4b and H5b were corroborated.
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Notes: \( n = 304 \); *correlation is significant at the 0.05 level (2-tailed); **correlation is significant at the 0.01 level (2-tailed)
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Notes: $n = 304$; standardized regression coefficients are shown; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$
The first step of the regression analysis testing the contribution of the control variables to the explanation of the endorsement of the ‘Lying’ tactics rendered a significant regression model \((F = 10.38, p < 0.001)\). Age \((\beta = -0.35, p < 0.001)\) and gender \((\beta = -0.14, p < 0.05)\) explained 11 per cent of the total variance of the first-step model. The regression model of the second step was also significant \((F = 10.45, p < 0.001)\), increasing the total variance explained from 11 per cent to 24 per cent. The coefficient of vertical collectivism was positive \((\beta = 0.15, p < 0.01)\), while the coefficients of horizontal collectivism \((\beta = -0.20, p < 0.001)\) and ethical idealism \((\beta = -0.24, p < 0.001)\) were negative. Vertical collectivists displayed high tendency to accept lying tactics, while horizontal collectivists tended to endorse lying tactics less. Also, negotiators who scored high on idealism tended to endorse lying tactics less. Based on these results, \(H3c, H4c\) and \(H5c\) were supported. A detailed summary of all the significant relationships between the examined independent and dependent variables is presented in Figure 1.

5. Discussion
The research findings indicate that, negotiators’ vertical and horizontal individualism-collectivism properties, interpersonal trust and ethical idealism increased their tendency to endorse questionable negotiation tactics in the Germanic culture of Austria. The research findings revealed that Austrian negotiators value and accept deceptive negotiation tactics, such as extremely high opening demands and time pressure, which are related to traditional competitive behavior. These tactics have been empirically corroborated in some cross-cultural studies (Elahee et al., 2002; Volkema and Fleury, 2002; Volkema, 2004). ‘Lying’ tactics, such as false promises, misrepresentation, denial of informational validity, and unnecessarily tight deadlines, are regarded as ethically questionable and are the least acceptable by Austrian respondents. Other studies also support these results (Volkema, 2004; Al-Khatib et al., 2005).

The classification of questionable negotiation tactics along three factors, namely, ‘Pretending’, ‘Deceiving’ and ‘Lying’, used in previous research has been empirically corroborated in the Germanic culture of Austria. We argue that, for the Austrian culture, the items included in each category, represent an escalating degree of severity of the tactics. The significance of this finding is considerable, as it could allow the replication of these factors in

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**Figure 1.** Summary of the significant relationships between the independent and the dependent variables

Notes: (–) Negative relationship; (+) positive relationship
other organizations, industries and societies, revealing which items represent what level of tactics severity, depending on individual cultural predispositions. Previous classifications were nominal in nature and they did not allow for cross-cultural comparison. Hence, this study is a step towards enhancing theory on ethically questionable tactics from the descriptive to the explanatory level, making studies in negotiation tactics more robust and reliable.

The research results are analogous, yet not identical, to previous findings of research conducted in Israel and Kyrgyzstan (Banai, et al., 2014), Turkey (Erkus and Banai, 2011), Peru (Stefanidis et al., 2013) and Greece (Stefanidis and Banai, 2014). Vertical individualism properties of Austrian negotiators are important factors in the choice of negotiation tactics, revealing that negotiators who presented high levels of vertical individualism endorsed pretending tactics. At the same time, there was no significant relationship between individuals' horizontal individualism levels and their endorsement of questionable negotiation tactics, as Triandis et al.’s (2001) finding concluded. However, the results indicate that the differentiation between horizontal and vertical individualism (Singelis et al., 1995; Sivadas et al., 2008) provides us with more specific information than the traditional individualism-collectivism classification, and, therefore, it is more useful.

The results for horizontal and vertical collectivism in this study are consistent with those relationships suggested in past research (Triandis et al., 2001). While the endorsement of the deceiving and lying tactics by negotiators who scored high on horizontal collectivism was low, vertically collectivistic negotiators displayed a higher propensity to endorse ‘Deceiving’ and ‘Lying’ tactics. It could be argued that individuals who care about group harmony and relationships would prefer to avoid unethical negotiation tactics.

One group of researchers holds that there is a relationship between vertical collectivism and the tendency to avoid competition or to prefer avoiding conflict management styles (Kaushal and Kwantes, 2006; Komarraju et al., 2008). Tendency to behave deceptively can be driven by cultural values that stress sociability and benevolence (horizontal collectivism), rather than by values that emphasize hierarchy or deference to the in-group, such as vertical collectivism (Shavitt et al., 2006). Yet, other scholars argue that individuals who score high on vertical collectivism could be expected to display a tendency to endorse ethically questionable negotiation tactics. For example, Triandis et al. (2001) concluded that Japanese and Koreans, who predominantly display high levels of vertical collectivism, perceive some deceptive behaviors in negotiations as acceptable.

Our study indicates that the measure of vertical individualism predicts the endorsement of less severe questionable negotiation tactics, such as that of pretending tactics. The higher the scores on vertical individualism, the higher the tendency to endorse the Pretending tactics. Collectivism of both types, can predict the endorsement of the more severe tactics of deceiving and lying. Yet, higher scores on vertical collectivism predict higher tendency to endorse deceiving and lying tactics, while higher scores on horizontal collectivism predict lower tendency to use deceiving and lying tactics. These results support the approach of the second mentioned group of researchers, which is represented by Triandis (1995, 2001).

Regarding ethical idealism, Forsyth (1980) contended that individuals with higher levels of idealism deem it necessary that ethical dilemmas be solved based on universal rules. While idealist individuals believe in moral rules that do not offend people, individuals with lower levels of idealism make potentially offensive decisions more easily (Al-Khatib et al., 2005). Similarly, research on ethical issues in management and marketing showed that individuals with higher levels of idealism have a greater concern for ethics and for social responsibility (Vitell et al., 1993b; Singhapakdi et al., 1995). This study’s finding, that Austrian negotiators with high levels of idealism endorse ethically questionable negotiation
tactics less, is in line with previously reported research results (Banas and Parks, 2002; Al-Khatib et al., 2005; Erkus and Banai, 2011; Stefanidis and Banai, 2014).

Defining trust as social capital in negotiations at the personal and organizational levels, Butler (1999) argued that cultivating relationships of mutual trust incurred tangible and intangible benefits. Indeed, many researchers drew attention to interpersonal trust as one of the most important factors in ethical negotiation behavior (Butler, 1995, 1999; Elahee et al., 2002; Olekalns and Smith, 2009). Research shows that relationships of mutual trust decreased ethically questionable behaviors (Elahee et al., 2002; Elahee and Brooks, 2004; Olekalns and Smith, 2009). Based on our research findings, the correlation analysis showed significant positive relationships between trust and horizontal-vertical collectivism, idealism and age.

Our regression analyses indicate that interpersonal trust is also an important factor in the endorsement of pretending negotiation tactics. It can be argued that culture may bring about differences in trust relationships between negotiators, when looking at trust as a personal factor (Ross and LaCroix, 1996). Indeed, research exploring the relationship between trust and negotiations in a cultural context found cultural differences to influence this relationship (Elahee et al., 2002; Mintu-Wimsatt et al., 2005). No significant relationship was found between interpersonal trust and the use of the pretending, deceiving and lying tactics in Turkey (Erkus and Banai, 2011).

Another significant finding of the study relates to age; rising age diminishes the acceptance of ethically questionable negotiation tactics. Age has a significant negative impact on all three examined questionable negotiation tactics, namely, pretending, deceiving and lying. We may conclude that older negotiators endorse less ethically questionable negotiation tactics. The correlation analysis in Table II shows a significant correlation between age and the independent variables of trust propensity and ethical idealism. Previous literature has suggested that younger individuals tend to display lower ethical standards (McDonald and Kan, 1997; Weeks et al., 1999; Eweje and Brunton, 2010). Ethical variations related to seniority have been attributed to the egocentrism of youth, the pressure to perform and success early in life (Weeks et al., 1999), and to differences in economic and social conditions compared with those experienced by older individuals (Volkema, 2004).

Furthermore, our study reveals a significant correlation between gender and lying. Men tend to endorse pretending negotiation tactics more than women do. The results show no significant correlation between gender and the tendency to endorse deceiving and lying tactics. Gender is one of the leading variables of discussion in the field of negotiation. Research on gender differences shows that females are more cooperative than males and they tend to display a greater care for the other party’s expectations (Halpern and Parks, 1996; Walters et al., 1998; Calhoun and Smith, 1999). Research on negotiation ethics found that women do not endorse ethically questionable tactics as much as men do (Lewicki and Robinson, 1998; Robinson et al., 2000; Volkema, 2004).

This study has refined theory of questionable negotiation tactics by corroborating three tactics that gradually become more extreme in the Germanic context of Austria. The first tactic is pretending, which is referred in the literature as traditional negotiation tactic; the second is deceiving, which is the gray area, as some people in certain cultures may perceive it unacceptable, while others may consider it legitimate; and the third is lying, which people in most cultures would consider it contradicting social norms and, yet, deployable under certain circumstances, e.g. saving own life. The study also concludes that horizontal and vertical collectivism, as well as ethical propensity, are significant personal attributes that could be used to explain the tendency to endorse more extreme questionable tactics. Similarly to Erkus and Banai’s (2011) findings, the study could not corroborate the
relationship between interpersonal trust and the tendency to endorse non-traditional negotiation tactics. Similar findings in future studies may raise a question about what interpersonal trust is and why it has not been observed to relate to negotiators’ endorsement of questionable negotiation tactics.

6. Conclusion

6.1 Research implications

Despite the potential for opportunistic tendencies, multinational corporation executives continue to regulate their counterparts’ behavior through negotiated contractual agreements that display varying capacities to respond effectively to these tendencies (Williamson, 1985). Given the considerable resources needed to monitor opportunism and the opportunity costs of deals that may not be executed due to opportunistic behavior (Wathne and Heide, 2000), it is essential that firms develop the knowledge and expertise necessary to understand how to screen, select and negotiate with exchange partners prior to the establishment of business relationships that may prove ineffective and costly.

The present study contributes to the business negotiation literature in several ways. First, it enriches existing knowledge (Lewicki and Robinson, 1998; Robinson et al., 2000; Stefanidis et al., 2013; Banai et al., 2014) and conceptualizes ethically questionable negotiation tactics grading their severity from the more acceptable pretending to the questionable deceiving and lying tactics, hence providing risk assessing agencies with a scale to assess the risk involved in the negotiation process within a Germanic context. Second, the role of culture in ethically questionable negotiations that has been described in prior research (Triandis et al., 2001; Stefanidis et al., 2013) is corroborated in a sample of Austrian executives. Specifically, focusing on elements of negotiators’ individual cultural predispositions (namely, vertical and horizontal individualism and collectivism) and their influence on the endorsement of ethically questionable negotiation tactics, this study provides organizations with an instrument to predict and get prepared for negotiation with Austrian executives who display diverse cultural attitudes.

Third, despite the recent surge in business ethics research, international negotiation ethics have been sporadically investigated (Banai et al., 2014). This study reaffirms the previously suggested (Aquino, 1998; Al-Khatib et al., 2008) relationship between ethical idealism and tendency to endorse ethically questionable negotiation tactics in a Germanic culture. Once executives suspect counterparts’ tendency to apply ethically questionable tactics, they should get prepared to diffuse them. Expatriate managers and other international managers, such as headquarters officials responsible for international business or international purchasing managers, may receive training in cross-cultural negotiation ethics to better prepare for the successful completion of negotiations in foreign cultures, such as that of Austria. Fourth, based on this and other (e.g. Stefanidis and Banai, 2014) studies’ results, trust seems to be only partially a predictive tool in assessing tendency for unethical negotiation behavior. Cultural differences may help identify this tendency, and thus, the combination between culture and trust could enhance the possibility of detecting propensity to use questionable negotiation tactics. This finding sends a signal to negotiators that individual cultural differences need to be considered in trusting their counterparts’ ‘trust’ level within a negotiation process.

6.2 Limitations and directions for further research

This study has several limitations. First, the research has been conducted in a single society. Future comparative research in different societies may yield more comprehensive and elaborate findings. Second, mostly private sector employees have been included in this
research, and thus, testing the model on different samples, which would include a larger group of public service employees, may allow for more generalization, and more specific results. Future studies could also control for industry effects to test whether attitudes towards questionable negotiation tactics vary among industries. Third, given the significance of the involved parties’ age in negotiation, an investigation into the adoption of unethical tactics by more senior and more experienced executives could possibly provide a more robust validation of our reported research findings.

Fourth, attitude has been defined as “a predisposed tendency to respond to something in a favorable way” (Eagly and Chaiken, 1993). Kelman (1958) observed three levels of attitude changes in people, namely, compliance, identification and internalization. Individuals who internalize certain attitudes are likely to use them as a basis for judging negotiation behavior’s appropriateness and, hence, apply it. However, as Eagly and Chaiken (1993) propose in their composite attitude-behavior model, behavior is likely to be partially determined by attitudes, but the relation between attitudes and behavior is best understood by placing attitudes in the context of other factors, such as habits, intentions, and perceived utilitarian outcomes. This study investigated the respondents’ perceptions of their preferred negotiation tactics rather than their actual negotiation behavior. Similarly, it asked the respondents for their attitudes towards ethical behavior. As attitudes do not necessarily fully correlate with behavior, these results may not fully represent real-life negotiation tactics used in Austria. Future studies could include laboratory experiments in addition to the use of survey questionnaires.

Fifth, non-response may have been another research constraint. Research has shown that those who define themselves as aggressive and competitive tend to use ethically questionable negotiation tactics more than cooperative individuals do (Lewicki and Robinson, 1998; Robinson et al., 2000). It is possible that those who completed questionnaires were more cooperative than those who declined to do so and, therefore, were also more ethical than non-responders. Further, a limitation of our study derives from the bias inherent in the self-report nature of our survey (Podsakoff and Organ, 1986). Despite these deficiencies, for which there is no perfect remedy, our sample’s size and variance justify the robustness of our significant findings. Last, in this study we observed partial support for the role of specific antecedents, such as trust propensity, in negotiation ethics within the Austrian context. Hence, future replications of this study in other Germanic or non-Germanic milieus would have the potential to refine the model of the relationships among personal cultural attributes, ethical propensity, interpersonal trust and ethically questionable negotiation tactics.

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Manufacturing reshoring
A strategy to manage risk and commitment in the logic of the internationalization process model
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Abstract
Purpose – This paper aims to theorize on the internationalization process model to explain cases of manufacturing reshoring as decisions taken to manage risk when internationalizing.
Design/methodology/approach – The paper is of a conceptual nature. Building on the logic of the internationalization process model, the authors extend previous work by focusing on firms’ risk perception (determined by commitment, knowledge and uncertainty as key variables) to explain also reshoring decisions.
Findings – Four propositions were developed, concerning the likelihood of firms to make manufacturing reshoring decisions. The first two propositions deal with the effects of new risk contingencies, and the other two refer specifically to the effects of managerial perceptions of three different typologies of risk, namely, host-country, home-country and reshoring-process specific risk.
Originality/value – While reshoring has been discussed mainly on the basis of economic arguments, this paper offers an alternative, behavioural view of this phenomenon as a strategic risk-management process. Therefore, it offers initial steps to theorize about reshoring from a risk-management perspective and, in doing so, opens up a number of avenues for future research.
Keywords Risk, Reshoring, Internationalization process model
Paper type Conceptual paper

Introduction
In the past decades, manufacturing companies have been increasingly offshoring (and often also outsourcing) their production activities, mainly in low cost countries. However, more recently firms have been re-evaluating their initial decisions, redefining the location of in-sourced and out-sourced manufacturing activities. More specifically, the possible relocation alternatives are (Fratocchi et al., 2014; Foerstl et al., 2016) further off-shoring (i.e. relocation in even more distant countries), backshoring (relocation to the home-country) and near-shoring (relocation to a country close to the home one). This article is focused on the “manufacturing reshoring” phenomenon, i.e. the decision to relocate production activities from offshore to the firm’s home-country, independently of the adopted governance mode (out- vs. in-sourcing) (Fratocchi et al., 2014; Foerstl et al., 2016).
Interest in manufacturing reshoring arose initially among practitioners; more recently, it has gained momentum among policymakers (De Backer et al., 2016; Guenther, 2012; Livesey, 2012) and scholars (for up-to-date literature reviews, Barbieri et al., 2018; Wiesmann et al., 2017; Stentoft et al., 2016). After the seminal work of Kinkel et al. (2007), 75 articles and five book chapters were published as Scopus indexed documents. However, several recent studies point out that further research is much needed (Bals et al., 2016; Barbieri and Stentoft, 2016; Barbieri et al., 2018; Foerstl et al., 2016; Stentoft et al., 2016).

The phenomenon has often been referred using other terms (e.g. backshoring, back-reshoring, inshoring, back-sourcing and onshoring). However, in this article, we use the term “reshoring”, as it is the one most used among scholars. Furthermore, we focus attention only on manufacturing companies and exclude service companies, as the two relocation phenomena need a different approaches (Albertoni et al., 2017). Moreover, we limit our focus to “in-house reshoring” (Gray et al., 2013), i.e. in-sourced manufacturing activities, both at the off-shoring [i.e. Foreign Direct Investment (FDI)] and reshoring phases. This choice of focusing mainly on manufacturing activities and FDI (i.e. in-sourced offshoring) is also in line with the core research on the internationalization process (IP), which focuses on the establishment, in time and in a stepwise manner, of a firm’s activities within foreign markets in the context of manufacturing firms (Johanson and Vahlne, 1977).

International trade theory, strategic management theories (Resource-Based View and Transaction Cost Theory) and international business (IB) frameworks (Dunning’s Eclectic Paradigm and Internalization Theory) have so far been the most commonly adopted theoretical perspectives used to study the reshoring of manufacturing activities previously offshored through FDI. This manifests a clear tendency to extend ideas and models, mostly based on economic arguments, used to explain offshoring and internationalization strategy to explain also reshoring (Albertoni et al., 2017).

Based on the assumption that reshoring is considered a “voluntary choice” (Fratocchi et al., 2014), and considering that recent research – both empirical and theoretical – has stressed the importance of focusing on the decision-making process to understand the reshoring decisions (Bals et al., 2016; Gray et al., 2017), we argue the need to better understand the behavioural aspects behind making such a choice. Within the behavioural research tradition in IB (Figueira-de-Lemos et al., 2011; Johanson and Vahlne, 1977, 2009), the process of internationalization has been conceptualized as the increase of international resource commitment, along with knowledge accumulation. What a firm knows and learns influences decision-making and is crucial when evaluating the resources committed to international operations. Internationalization patterns, including decisions of reshoring activities such as manufacturing, can be seen as the outcome of adjustments to changes within a firm and to the firm’s environment (Figueira-de-Lemos et al., 2011). This perspective echoes that of Albertoni et al. (2017) who suggest that the dynamics that drive both FDI (in their example) and reshoring may be fundamentally the same. In a globalized world, more important than deciding on the allocation of resources is to decide on their contingent reallocation. In this sense, the decision to reshore a production activity can be theorized as part of a non-linear process of internationalization aimed at reconfiguring and reallocating resources (Fratocchi et al., 2015; Vissak, 2010; Vissak and Francioni, 2013).

Thus, as a possible component of the IP (Figueira-de-Lemos et al., 2011; Johanson and Vahlne, 1977, 1990), reshoring can be viewed specifically as at least a partial reduction of commitment. Within such a theoretical framing, it becomes interesting to discuss how the interplay of the factors that drive the process of internationalization (knowledge, learning and uncertainty) may in certain instances also lead to a reshoring decision, i.e. bringing back manufacturing activities that were previously offshored through FDI to the home-country.
Moreover, adopting a contingency process view on a firm’s international path introduces a risk-management conceptualization that is embedded in previous studies looking at the IP (Figueira-de-Lemos et al., 2011; Johanson and Vahlne, 1977, 1990). Uncertainty and possible negative consequences are critical in managers’ risk perceptions (March and Shapira, 1987) and are assumed to influence a firm’s commitment decisions. Risk may increase not only in relation to the amount of commitment the firm has in a foreign market but also follows increasing uncertainty – for example, when new competitors appear, when political instability arises or economic conditions alter (Figueira-de-Lemos et al., 2011; Johanson and Vahlne, 1977). Finally, if reshoring is a managerial decision, it then becomes important to include managers’ risk perceptions as determinants of such a decision and to carefully consider the level and locus of decision-making.

With the intent to further enhance our understanding of the reshoring phenomenon, the aim of this paper is to apply a behavioural approach to discuss the determinants of the reshoring decision making process focused on firms’ offshored manufacturing activities in the form of FDI. Specifically, we theoretically examine the relationship between a firm’s knowledge, commitment and uncertainty in relation to its risk perception to put forward a series of propositions on what drives the likelihood of taking a reshoring decision.

This paper makes a number of contributions to IB research by introducing a framework for understanding behavioural and risk management aspects related to decisions of reshoring concerning previously captive offshored production activities. Thus, it complements the current predominantly economic thinking on reshoring. We present a more nuanced characterization of risk by discussing three different kinds of risk associated with reshoring: host-country related risk, home-country related risk and reshoring-process specific risk. We argue that by disentangling the drivers of the reshoring decision, the complexity of the decision is better captured than if the analysis had focused only on the host-country. Finally, this paper introduces the concept of “likelihood of reshoring” as well as provides support to the view of reshoring as a non-linear IP.

The remainder of the paper is structured as follows. First the phenomenon of reshoring, as discussed in extant literature, is introduced. Second, the motives most commonly associated with reshoring decisions are reviewed. Thereafter, the IP model is introduced as a framework through which to understand reshoring from a behavioural perspective and as a risk management decision. Using the logic of the IP model, two propositions are postulated that explain when a reshoring decision is likely to be made. We then proceed to suggest another two propositions focusing on the relevance and implications of other loci of risk, in addition to the host-country, for reshoring as a risk-management decision. Having presented a model summarizing all four propositions, this paper highlights the importance of different assumptions about learning and decision-making. Reflecting both the model and this discussion, a range of avenues for future research is presented that arise from the novel approach to reshoring applied in this paper.

Current perspectives on reshoring
As earlier pointed out, manufacturing reshoring is one of the alternatives available to the company after offshoring (Joubioux and Vanpoucke, 2016; Murat, 2013). This research topic has increasingly been attracting the attention of scholars, even if some of them used other terms for this phenomenon. Furthermore, it has been demonstrated that reshoring is an autonomous concept with respect to other ones (e.g. “foreign divestment” (Belderbos and Zou, 2006; Benito, 1997) and “de-internationalization” (Benito and Welch, 1997; Turcan et al., 2010)) belonging to the IB and international operation management research fields (Fratocchi et al., 2014). Therefore, reshoring decisions do not necessarily imply closing
plants or disinvesting a whole subsidiary. Accordingly, reshoring has been conceptualized as a more fine-tuned kind of step in the IP of the firm (Fratocchi et al., 2014, 2015), or a location choice (Gray et al., 2013). More specifically, it has been conceptualized as one of the possible evolutions of the “non-linear” (Vissak, 2010; Vissak and Francioni, 2013; Vissak et al., 2012) IP of production activities (Fratocchi et al., 2014, 2015). The firm’s preference towards reshoring instead of near-shoring, or further offshoring, depends on the careful evaluation of push factors (that discourages remaining in the host-country, such as loss of flexibility) and pull factors (that incourages reshoring, such as stronger IP protection).

Barbieri et al. (2018) have recently proposed a structured literature review of the manufacturing reshoring, adopting a “5W and 1H”, i.e. investigating the What-Who-Why-Where-When and How dimensions of this phenomenon. With respect to the conceptualization (What) of this relocation strategy, dissimilarities mainly concern:

- the country to which manufacturing activities are relocated (home vs “near to home country”; Bals et al., 2016; Ellram et al., 2013; Stentoft et al., 2016);
- types of relocated activities (manufacturing vs “primary and support activities”); or
- the governance mode (in- vs out-sourcing) of the offshored and reshored activities (Arlbjørn and Mikkelsen, 2014; Bals et al., 2016; Ellram, 2013; Gray et al., 2013; Lam and Khare, 2016; Uluskan et al., 2016).

However, it is generally recognized that a certain consensus has been reached regarding the most relevant features of the manufacturing reshoring phenomenon. In contrast, the “Who” issue is one of the less explored (Barbieri et al., 2018), as it is not clear if the propensity to reshore manufacturing is somehow related to specific firm characteristics (e.g. size, industry, export propensity) that can impact on the relocation decision (Canham and Hamilton, 2013; Di Mauro et al., 2018; Fel and Griette, 2017; Gray et al., 2017; Kinkel, 2014). At the same time, the “Where” question – which concerns the key geographical characteristics of reshoring, i.e. the home and host countries – has been investigated mainly in a descriptive way and focused on very few geographical areas (Canham and Hamilton, 2013; Fel and Griette, 2017; Kinkel, 2014). In fact, scholars rarely addressed reshoring decisions considering any country-specificity (Grappi et al., 2018). Similarly, the “When” issue has been rarely investigated, as the phenomenon only became relevant in the 2000s. Therefore, it may still be considered as “recent” when compared with the offshoring waves implemented since the 1990s. At the same time, there is no strong evidence that the reshoring phenomenon was significantly influenced by the global crisis of 2008-2009. As far as the “How” question is concerned, it refers to the decision-making and implementation process of reshoring, i.e. “how” firms decide to reshape and “how” they put such a strategy into practice. Also this issue was almost ignored until 2015, but some contributions have been proposed in the past two years (Bals et al., 2016; Gray et al., 2017; Hartman et al., 2017; Mugurusi and de Boer, 2014).

The most investigated issue on manufacturing reshoring belongs to the “Why” question, which is the reason why reshoring happens to deserve attention (for up-to-date literature reviews, see Bals et al., 2016; Barbieri et al., 2018; Fratocchi et al., 2016; Stentoft et al., 2016; Wiesmann et al., 2017). However, in much of the research on reshoring to date, scholars have simply focused on identifying and listing various driving factors. Moreover, important progress has recently been made in applying specific explanatory models, as done for instance in the work on reshoring of service firms by Albertoni et al. (2017). As this is a nascent approach in research on reshoring, few authors have yet used specific theoretical
frameworks to explain reshoring. Specifically, in IB the two most popular frameworks considered are internalization theory (Buckley and Casson, 1998) and Dunning’s eclectic paradigm (Dunning, 1980, 1998), while in strategic management, both transaction cost theory and the resource-based view have been considered in relation to the choice of location for a firm’s activities. In the following subsection, we further elaborate on the extant literature on reshoring motives.

Internalization theory and Dunning’s eclectic paradigm were originally developed to explain the international expansion of the firm but have been found applicable in general to location decisions, including reshoring. Internalization theory assumes that the acquisition of direct control (i.e. FDI) over scarce, knowledge-based resources allows firms to exploit the benefits of a location’s specialization, while reducing the (high) costs of managing complex transactions in foreign environments. From an internalization perspective, reshoring can be explained by changes in the fundamental characteristics of the world economy (Casson, 2013) – which reduces the value of local specialization – or by the increased (relative) costs of managing ownership in a distant location (Martínez-Mora and Merino, 2014). Dunning’s eclectic paradigm motivates firms’ IP based on three key types of advantages: ownership, internalization and location. As such, the eclectic paradigm includes both firm-level and location-level factors. As manufacturing reshoring (Gray et al., 2013) is a location decision that alters the degree of a firm’s FDI, in terms of Dunning’s work it can be interpreted as a response to a deterioration of one or more of the advantages (Dachs and Kinkel, 2013). For example, Ellram et al. (2013) show that changes in the characteristics of host locations (i.e. in the locations’ advantages) influence reshoring decisions. In line with this, several companies decided to move production activities back because of reduced differences in wage costs between China and the USA (Sirkin et al., 2012). Martinez-Mora and Merino (2014) show that several Spanish footwear companies were able to understand the occurrence of key changes in their competitive environment – namely the reduction in the difference of manufacturing costs between Spain and China, weakening demand and changes in the pattern of distribution – and consequently to respond by undertaking reshoring initiatives. Gylling et al. (2015) discuss how changes such as less favourable exchange rates, increases in offshore production costs and augmented seasonality and flexibility requirements, reversed the relative differences in economic attractiveness between home and offshore locations and subsequently led to decisions to reshore. Interestingly, in the latter case, the restored cost competitiveness of the firm’s home location was also driven by factory improvements due to production rationalization – showing that reshoring can be a reaction to changes which happen not only outside the organization and at different levels (e.g. industry-, country- and global level) but also to changes inside the firm.

Other authors, adopting a strategic management perspective, have referred to transaction cost theory (Williamson, 1975) and the resource-based view (Teece et al., 1997) to provide theoretical motivations for reshoring. From a transaction-cost perspective, reshoring could be driven by the higher coordination and control related costs of globally extended supply chains (Kinkel and Maloca, 2009; Martinez-Mora and Merino, 2014). In this respect, it is interesting to cite the case of companies repatriating production activities to better connect R&D, engineering and manufacturing units (Fratocchi et al., 2016). From a resource-based perspective, the relocation of manufacturing to the firm’s home-country could reflect that the firm is unable to develop distinctive resources abroad, or to properly exploit the host-country ones to establish competitive advantage (Canham and Hamilton, 2013). This is the case of reshoring decisions based on the “made in effect” (Diamantopoulos et al., 2011), which is especially relevant for consumer goods (Ashby, 2016; Canham and Hamilton, 2013; Robinson and Hsieh, 2016). In this respect, Grappi et al. (2015) have...
demonstrated that customers tend to assign a higher value to products if they know the company has reshored its production. For instance, the Italian mountain boots maker Fitwell realized that there was a niche market in Europe which recognized “made in Italy” as a considerable value added (Baraldi et al., 2017), which echoes the experience of other Italian companies in the fashion industry (Di Mauro et al., 2018).

Scrutinizing the reshoring literature, we can see how, while the choice of theoretical approach may vary, there is still significant theoretical consistency of the frameworks of reference adopted so far in the literature. Internalization theory adopts arguments from transaction cost theory and the resource-based view to explain the efficiency aspects of multinational corporations (Rugman, 2010). In Dunning’s eclectic paradigm, ownership advantage emphasizes the relevance of controlling distinctive resources and capabilities, and as such, it is quite consistent with the resource-based view (Sun et al., 2012); internalization advantage highlights the superior efficiency of internally managed transactions under the high uncertainty of international environments, in many ways adopting a transaction cost theory argument (Rugman, 2010).

Recent reviews of the literature provided classifications of specific motivations for reshoring (Barbieri et al., 2018; Fratocchi et al., 2016), which show how previous literature is examining this phenomenon primarily from an economic-strategic perspective (with customer perception of value and cost efficiency as the most common reasons for reshoring activities). However, identifying different explanations for reshoring by reducing them to only economic or transaction factors is here argued to limit our understanding of the phenomenon. In line with the aim of this paper to further understand the reshoring phenomenon, we argue that research needs to look closer at what factors influence the likelihood of managers taking a reshoring decision ex ante, besides the work done so far on analysing the motives that may rationalize such decisions ex post. Moreover, when looking at reshoring as a voluntary choice, there is a clear need to address the behavioural aspects, which so far have received very limited attention in the literature.

**Reshoring as risk management**

The IP model suggests that the currently perceived risk in a given market is a function of the firms’ commitment to this market in relation to the market’s uncertainty. Viewing risk as the relationship between a firm’s commitment to a particular market on the one hand, and the uncertainty faced in this market on the other, allows a risk-management perspective to take into account that an increase in uncertainty may have a considerable impact on the risk that managers perceive their assets to be subject to and therefore also on their subsequent risk-management behaviour. Therefore, we propose a behavioural view of the reshoring decision-making process in accordance with the IP model (Johanson and Vahlne, 1977, 2009).

A key aspect of the IP model is that firms’ learning generates knowledge, which in turn diminishes uncertainty and influences commitment decisions (Johanson and Vahlne, 1977). Following previous studies in this area (Figueira-de-Lemos et al., 2011; Johanson and Vahlne, 1977), we assume that although managers may accept increased risk as part of an opportunity-seeking internationalization, they can also be risk averse, i.e. seeking to avoid risk above what they consider to be a “tolerable” level, and especially so when faced with increasing uncertainty in a market into which the firm has ventured (March and Shapira, 1987). Firms make new commitment decisions, as well as decisions to reduce commitment (which would include the option of reshoring), on the basis of their risk perception, all the time. Thus, framing reshoring within a risk-management view, aligned with previous research on the IP, contributes to the understanding of the reshoring decision-making
process and helps to further explain the motives of reshoring already discussed in the literature.

Previous research argues that in the IP model, perceived risk increases as commitment increases (Figueira-de-Lemos et al., 2011; Johanson and Vahlne, 1977, 1990). If a firm is positioned in a higher risk level than what is tolerable, the immediate act of correction can be accomplished by the relocation of the firm's assets, or even a total divestment, to decrease the market commitment and, consequently, adjust the risk level. However, the firm's variation of commitment (e.g. an asset is acquired or divested) has an immediate effect on perceived risk, but not on uncertainty. It is only through acquisition of new knowledge (i.e. through learning in time) from existing or increased local operations (i.e. through increased commitment) that a firm can affect the level of uncertainty.

**Commitment**

A firm's commitment to a particular market is a variable represented by two dimensions:

1. the amount of resources invested; and
2. the extent to which those resources are irreversible (Hadjikhani, 1997; Johanson and Vahlne, 1977).

The amount of resources invested can be related to investment in production, distribution, sales or other kinds of resources. Meanwhile, the commitment degree can be seen as an issue of vertical integration (Johanson and Vahlne, 1977, 1990) and as reflecting the irreversibility of investments in buildings (Hadjikhani, 1997) or in other property (Woodcock et al., 1994). The idea of irreversibility is similar to the concept of "sunk costs" where it is not possible to liquidate the asset without a considerable loss of value, as specialized machines or manufacturing facilities may not be easy to convert for use for other purposes or in other locations. Despite the focus on plant and other operational facilities, an intangible commitment may be as financially important as a tangible commitment, so long as it is equally irreversible. Thus, considering the commitment variable in terms of both amount and irreversibility becomes important to better understand the choice of reshoring. In our conceptualization of reshoring, we want to explicitly focus on manufacturing operations as these clearly fit the original work on the IP (Johanson and Vahlne, 1977; focused on manufacturing firms) and as they represent the highest level of commitment in the reasoning of the IP model.

**Knowledge**

The commitment decision, in turn, is based on the experiential knowledge of the foreign market of the committing firm (Johanson and Vahlne, 1977); or, as pointed out explicitly by Johanson and Vahlne, in the IP model “knowledge of opportunities and problems is assumed to initiate decisions” (Johanson and Vahlne, 2009, p. 1418). When emphasizing that “commitment decisions are based on several kinds of knowledge” (Johanson and Vahlne, 1977, p. 24), there is an important distinction to be made between two main kinds of knowledge relevant for internationalization: (1) objective knowledge and (2) experiential knowledge. Objective knowledge, on the one hand, is explicit and transferable. Objective knowledge is important to a firm's strategic planning and can help, if found to be reliable over time, the firm to prognosticate commitment decisions. Experiential knowledge, on the other hand, is tacit and therefore difficult to transfer. Moreover, while objective knowledge may be readily available at any time, experience-based knowledge takes time to acquire and therefore lags any changes in the market. Such experiential knowledge is the
result of the direct commitment of a firm to a given market and is required to reduce uncertainty in ways that changes managers’ perceptions of market risk and thereby also influences their future commitment decisions. Based on the firm’s own experience in the relevant market, such experiential knowledge is seen as particularly valuable to inform and fine-tune major future commitment decisions.

Therefore, we argue that knowledge is a critical dimension when considering reshoring as essentially a risk-management decision. The particular observation that experience in the local market in time will affect managers’ risk perception can be seen as closely related to the case when reshoring is explained as a reversal of past commitment mistakes (Gray et al., 2013; Kinkel and Maloca, 2009). Considering that learning is emphasized as an important driver of both market commitment decisions in internationalization studies and of manufacturing reshoring decisions in the reshoring literature, this indicates that a behavioural approach in line with the IP model logic can contribute with novel perspectives on learning as drivers of reshoring decisions.

**Uncertainty**

The IP model makes a distinction between two kinds of uncertainty. One is referred to as “pure uncertainty”, a constant kind of uncertainty, while the other is called “contingent uncertainty”, which is a kind of uncertainty that is dynamic in the sense that it can be reduced. Pure uncertainty is based on the notion that, as long as there is a future that is not completely certain, there will always be uncertainty that is beyond the firm’s ability to reduce or plan for. Contingent uncertainty, however, may be reduced by applying skills and knowledge (Knight, 1921) as well as by taking directed measures of risk control (March and Shapira, 1987). Such contingent uncertainty is thereby knowledge-dependent and is seen as subject to the limits of bounded rationality, while the “pure uncertainty” concerns essentially unpredictable and unavoidable futures (Figueira-de-Lemos et al., 2011). As for the issue of contingency, the IP model sees this as an occurrence which could happen and that a firm therefore also could be prepared for by having contingency plans which cover such occurrences (Johanson and Vahlne, 1977; Figueira-de-Lemos et al., 2011). The manner in which the IP model uses “contingent uncertainty” suggests that increased learning will allow for a better understanding of risks, evaluation of alternative responses, and facilitation of the contingency planning needed to deal with these risks.

This link between the firm’s knowledge and contingent uncertainty, the latter being the focus in this article and therefore what we from now on refer to simply as “uncertainty”, suggests that this is both a particularly important variable in risk management, and thereby in reshoring decisions, as well as one that is subject to continuous, and sometimes rapid, change. As managers over time learn about the local market conditions through the firms’ operational commitment to that market, their ability to calibrate their understanding of risk improves along with their ability to prepare contingency plans should any problematic event materialize. The idea of contingency planning as a risk reduction tool echoes work in the reshoring literature focusing on the use of decision-making tools to reduce risk related to foreign market commitments (Kinkel and Maloca, 2009).

**Risk**

While risk can be analyzed at different levels of aggregation (Müllner, 2016), what is referred to in the IP model logic is the country level risk. More specifically, risk as discussed in the IP model suggests that the current perceived risk in a given market is a function of the firms’ commitment to this same market in relation to the market’s uncertainty. However, increased risk does not merely result from an increase in the scale of the firm’s operations in a given
market (i.e. from increased commitment) but may also occur as a consequence of an increase in the uncertainty specifically related to this market. Examples of such uncertainty increases are when new competitors enter the focal market; when already present competitors field novel processes, products or technologies; or in cases of environmental, political or economic turmoil. In instances such as these, the uncertainty increase would be wholly unrelated to changes in commitment (Johanson and Vahlne, 1977; Figueira-de-Lemos et al., 2011). Viewing risk as the relationship between a firm’s commitment to a particular market and the uncertainty faced in this market, allows a risk-management perspective to take into account that an increase in uncertainty may have a considerable impact on the managers’ risk perception and therefore also on their subsequent risk-management behaviour.

This way of understanding reshoring decisions is related to viewing them as a manifestation of “non-linear internationalization” (Fratocchi et al., 2014, 2015), a process characterized by frequent re-evaluation of firms’ location commitments (Vissak, 2010; Vissak et al., 2012; Vissak and Francioni, 2013). Although emphasizing why reshoring can be seen as a more common decision than much other literature would suggest, non-linear internationalization still sheds little light on how reshoring decisions can be understood. Our view of the reshoring phenomenon centres on the notion that managers’ “perception” is a pivotal factor in taking decisions. Thus, when looking at the motives leading to reshoring we can put forward a clearer distinction between decisions that are influenced by a sort of risk management purpose in line with the behavioural arguments of the IP model, as compared to those more in line with the economic tradition. While the IP model considers knowledge and commitment to be variables that are internal to the firm, uncertainty is largely external. These differences between where the variables of the framework originate from are critical for appreciating how, from a behavioural standpoint, managers and entrepreneurs manage perceived risk, and highlights that firms may use their level of commitment to calibrate the level of risk to which they are exposed.

Levels of risk and the decision of reshoring
In the IP model, increased commitment leads to increased knowledge, but with a lag as it takes time to build experience-based knowledge. In time, increased knowledge, if all else remains equal, will lead to reduced uncertainty in the host market. Therefore, the more experiential knowledge a firm gains from its operations in a host-country, the greater will be the decrease in uncertainty, and thereby in perceived risk related to the host-country operations (Figueira-de-Lemos et al., 2011; Johanson and Vahlne, 1977, 1990). Below follows a discussion on, and elaboration of, the logic already outlined in the previous sections.

If a firm’s internationalization to a particular market is at an advanced stage, i.e. when it has established its own manufacturing operations, major increases in commitment would be required for the firm to further increase its knowledge to the extent that it can decrease any additional uncertainty. Reduced uncertainty, in turn, lowers perceived risk; but risk reduction occurs only if knowledge attained as a consequence of having expanded commitment is enough to handle the uncertainty that caused the increase in risk in the first place. This suggests that increasing commitment (to generate new knowledge) is a viable risk-management option only under certain circumstances.

Moreover, as uncertainty will remain unchanged at a specific point in time, changing the level of a firm’s risk in a given market may only be immediately accomplished through either the acquiring or divesting of assets. However, when a firm experiences a level of risk that is higher than it considers acceptable, and new commitment (to reduce uncertainty) is not viable because of resource or time constraints, the logic of the IP model would suggest that an instantaneous adjustment of this risk level may be achieved through a reduction of
the firm’s commitment to the particular market. In this case, we may see the firm taking decisions to reconfigure its operational assets by reshoring.

Thus, the “likelihood of reshoring”, i.e. the managers’ propensity to take the decision of transferring one or more manufacturing activities currently located in the host-country back to the home-country, is influenced by the potential limits of adjusting risk levels through new commitment and learning. The relationships and the chain of arguments between these variables and the likelihood of reshoring from a risk-management standpoint are illustrated in Figure 1.

Assuming that a change in the level of uncertainty will trigger a change in the level of perceived risk, we can now turn to discuss the effect this would have on a firm’s commitment level, thus contemplating the likelihood of the reshoring decision to occur (Figure 2). Considering the case of a firm with established manufacturing operations in a foreign market, Point A in Figure 2 (i.e. high commitment and low level of risk), an increase in uncertainty would move the firm to Point B (i.e. high commitment and high level of risk). As we will discuss below, this will under certain circumstances (related to the firm’s resource and time constraints) be likely to lead to reshoring (Point C).

When theorizing about what circumstances make managers reshore operations as an act of risk management, one key assumption needs to be considered. The IP model assumes that firms’ managers are boundedly rational. This assumption (Williamson, 1985) suggests that
although a firm does not have perfect knowledge of the market in which it operates, it nevertheless has a fairly good grasp of what knowledge it is lacking and, as a consequence, of how it can adjust and manage the firm’s commitments in light of this. Therefore, when a firm is assumed to be boundedly rational, it is also assumed that the firm has a current level of commitment that is correctly adapted to the perceived market risk it is facing. As a consequence, the firm is assumed to react to any increase in uncertainty and perceived risk by making a “roughly correct” risk-management decision.

In this sense, reshoring may be perceived as a correct choice, given the change in uncertainty, or it could be the only available choice as the firm’s ability falls short of the new demands presented by the external change of an increase in uncertainty. In fact, an increase in uncertainty may require that a firm increases its commitment to a specific host-market at a time when, or in a situation where, the firm lacks the ability, or willingness, to do so. In line with the above discussion on commitment and learning, we argue that the inability to cope with increased uncertainty may be typically related to a lack of available resources to commit further and a shortage of time to learn. It is reasonable to expect that uncertainty can vary in its degree, as changes can be different in nature and more or less radical. The greater the changes occurring in the environment the more extended their effects on the firm will be. A higher degree of uncertainty does not only imply relatively substantial further requirement of resources to commit as well as lengthier processes of analysis and gathering of new knowledge but also may diminish a firm’s interest in being exposed to a market (or the other way around, the attractiveness of the market substantially diminishes). Thus, excluding the “pure” rational situation in which economic comparison of costs and benefits between host- and home-countries can be calculated, and this then determines the case of reshoring for merely economic convenience, we suggest that reshoring decisions may be triggered by increased uncertainty and under bounded rationality assumptions. Specifically, assuming a change in uncertainty that increases the risk perceived and evaluated by the individual firm, i.e. excluding “shocking” changes in uncertainty that would make reshoring or full disinvestments the only alternative for everyone (e.g. a war), we elaborate the following two propositions:

\[ P1. \] The lower the availability of resources required to increase the commitment (enough to counter the increased uncertainty), the higher the likelihood of reshoring.

\[ P2. \] The greater the time required to learn (enough to counter the increased uncertainty), the higher the likelihood of reshoring.

**Reshoring and different origins of risk**

From a risk management perspective, it is important to consider what the origins of risks are, i.e. where the risk that influences reshoring decisions as risk-management actions has its source. In our reasoning, as well as in that of the IP model, it is implicitly assumed that what is important is the host-country perceived risk. However, and as we will elaborate on in the section below, risk is not absolute but relative, as becomes apparent if we pose the question: “higher risk compared to what?”

*Risk perception; host- versus home-country risk*

Both the IP model and much of the manufacturing reshoring literature has been primarily focused on conditions in the foreign country from which reshoring is made. However, the logic of viewing reshoring as a risk-management decision from a behavioural perspective
raises questions of not only the absolute risk of the host-country, but also the “relative risk” as compared to that of the home-country, which in a reshoring decision is the explicit alternative. This, in turn, introduces a situation where the perceived risk of the host market is weighted against the perceived risk of the home market to which manufacturing operations might be reshored. Although it is easy to imagine the home-country as low-risk compared to foreign markets, this is not necessarily always the case as new competitors and technology can increase risk in home-markets just as readily as in host-markets. The reasoning is similar to the typical IB analysis undertaken between potential host countries, where firms should evaluate and compare different countries (as potential targets for their internationalization) by comparing their relative risk factors. Firms in general may simply look for a new location to avoid difficult challenges (Manning, 2014), and those that are about to decide on the possibility of reshoring are faced with a relative risk analysis between host- and home-countries.

This means for instance that reshoring decisions may be postponed or not even taken if the home-country risk related to bringing back activities is higher than the risk of remaining abroad. Interestingly, this suggests that if the perceived risk in a given host market rises above tolerable levels, this can still only be thought to lead to reshoring if the perceived risk in the home market either decreases or remains the same[1]. Likewise, a firm may decide to reshore not because the risk has increased in the host-country, but because it has decreased in the home-country.

Therefore, a reshoring decision is more likely to occur when host-country risk is perceived as increasing or when the home-country risk is perceived as decreasing, and based on this reasoning we postulate the following proposition:

P3. The higher the relative risk of host-country compared to home-country, the higher the likelihood of reshoring.

This line of thinking is illustrated in the 2-by-2 (Figure 3). Boxes 2 and 4 are the most typical situations where a reshoring decision might be faced by firms as uncertainty is increased in

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<td>Increase</td>
<td>1. FURTHER COMMITMENT</td>
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<td>Decrease</td>
<td>3. DEPENDS ON RELATIVE CHANGE</td>
<td>4. RESHORING</td>
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Figure 3. The balanced influence of home vs host-country perceived risk on reshoring
the host-country. Boxes 1 and 3 are instead situations presenting decreasing uncertainty; therefore, our reasoning focuses on the different level of uncertainty in comparison with the home-country only. This means that although firms might not often be triggered to consider reshoring in the case of decreasing uncertainty, they might still improve their risk level when both home- and host-country risk levels vary considerably.

Box 1: If the perceived risk of the home-country increases but that of the host-country decreases, a decision based on relative risk is likely to lead to further commitment in the host-country. Box 2: If the perceived risk of the host-country increases and that of the home-country increases as well, a decision based on relative risk will lead to reshoring or not depending on the relative degrees of these two increases. If the increase in the host-country is great, and the increase in the home-country is small, this will lead to reshoring because of the relative increase in risk of the host-country. If the increases in risk are proportional, the relative risk remains the same; hence, it does not lead to a reshoring decision. Box 3: In this box, the same logic applies as in Box #2, but instead of increasing risks in both home- and host-country, there is a decrease of risk in both. This means that if the decrease in perceived risk is not proportional, this will alter the relative risk between the two countries. Therefore, if the decreases in perceived risks leave the host-country relatively much more risky than before, this will lead to reshoring. Box 4: If the risk of the host-country increases, while the risk of the home-country decreases, this will tip the balance of relative risk against the host-country and lead to a reshoring decision.

Finally, we need to underline that when evaluating reshoring, the risk related to the home-country needs to be complemented with the intrinsic “reshoring-process specific risk”. The inherent risks in the process of reshoring concern both those related to practical and operational risks surrounding the reshoring process and those related to human resources management (Bals et al., 2016). Reshoring operations often require considerable investments, for instance in logistics and facilities, and such costs are not easy to fully predict. When reshoring operations, there are many things that risk not going according to plan and which may pose additional challenges to the reshoring process. For example, it is not uncommon for firms to attempt to relocate operations only to find that establishing working relationships with specialized suppliers and other critical infrastructure is harder and takes longer than expected (Baraldi et al., 2017). Moreover, and from a perspective of human resources management, turnover can increase drastically in relation to relocations, and hiring and training new workers in the home market may take time and effort that can, in a competitive environment, be seen as high risk as well. These are just two examples of risks that are directly related to the reshoring process itself. These “reshoring-process specific risks” (in addition to the host-country risks and home-country risks) can be expected to influence the evaluation of risk that underlies a decision to reshore and should also be considered when evaluating the risks of the home-country. Based on this reasoning, we postulate the following and final proposition:

P4. The greater the reshoring-process specific risk, the lower the likelihood of reshoring.

Figure 4 summarizes our argumentation; (with dotted lines) the context of the four propositions previously presented, where learning (in terms of time needed to accumulate new knowledge), commitment (in terms of resources), and perceived uncertainty are discussed in relation to the likelihood of reshoring (as a means to reduce risk); and (with thick black arrows) the relationships between the different types of risks and the likelihood of reshoring.

This two-step approach of disentangling the drivers of the reshoring decision shows first a within-host-country reasoning and, second, shows the importance of a between-country and reshoring-process analysis of potential sources of risk. In this way, the complexity of the
reshoring decision is shown more in full than if the analysis had focused solely on the host-country. This framing is important as it highlights the potential managerial limitations to tackling the reshoring decision, which here is portrayed as considerably more complex than the mostly economic and cost-related factors that thus far have dominated the literature on reshoring. Key aspects related to such managerial limitations that we now intend to bring to the fore are related to the questions of “who is learning” (i.e. who has the knowledge to evaluate the reshoring decision) and “who is deciding”. We further elaborate on these aspects in the following section by discussing some core assumptions related to the location and dispersion of knowledge and decision-making, in relation to reshoring.

**Assumptions about learning and decision-making**

Having postulated the main propositions of this paper, we now turn to a less strict discussion of how some of the central assumptions of the IP model may affect our further understanding of reshoring as a risk-management decision. Therefore, following the discussion above, a reshoring decision should be framed in the comparison between the perceived risks of the reshoring process, but also of the host-country and those of the home-country to which it might be reshored. However, whether knowledge of both markets is held by the same actor, i.e. the decision maker, becomes a concern. The IP model essentially deals with the firm and not with the decision-making locus within the firm per se: “In our model we consider knowledge to be vested in the decision-making system. We do not deal explicitly with the individual decision-maker” (Johanson and Vahlne, 1977, p. 26). This quote suggests that there is one decision maker, rather than many, which suggests understanding reshoring requires further elaboration. The question of “who is learning” in the IP model has been highlighted before (Forsgren, 2002), yet we argue that this question and related assumptions have particularly far-reaching consequences for how the firm can be expected to perceive, and as a consequence also for our understanding of reshoring.

Tackling the issue (and related assumptions) of “who is learning” raises specific questions about whether the same managers are those who perceive risk in both the home- and host-market. If this is not the case, the question of whether they perceive risk differently becomes particularly consequential for how it can be expected to influence reshoring decisions. While the IP model suggests that experiential learning takes place locally (Johanson and Vahlne, 1977, 1990), the activity of reshoring suggests that a decision to reshore, considering its strategic and supra-local nature, could as likely be taken centrally (or at least be strongly influenced) by headquarters. As a consequence, the question of “who is learning?” becomes especially interesting when paired with the additional question of “who is deciding?”.

**Figure 4.**
Risk and the likelihood of reshoring
Following the logic, if not the letter, of the IP model, it is assumed that the local subsidiary manager is the one learning about the local market. This suggests that the local manager, or the local management team, will learn about the local market through their experiences and subsequently make a decision to reshore providing that the risk is above the tolerable level and that the circumstances do not provide other options (as proposed earlier and illustrated in Figure 3). In contrast, headquarters may have less experience-based knowledge of the host market but instead have knowledge of the home market. This would indicate that there is ample opportunity for headquarters and the local host-country subsidiary to not only draw different conclusions as to whether reshoring is the appropriate action but also to do so on different grounds.

Another critical assumption related to the issue of “who is deciding” is the one of path dependency. The IP model is at its core a process model about ongoing business activities (Johanson and Vahlne, 1977, 1990). However, the way commitment, experiential learning, and perceived uncertainty relate to each other suggests not only an incremental behaviour but also a certain path dependency in this behaviour. Put differently, if no major shocks occur, local operations can be expected to continue expanding as long as they are profitable. Assuming that reshoring is based on the learning of the local subsidiary, this implies that such decisions are at risk of being influenced by this path dependency. More specifically, it may lead to inertia and that the decision to reshore may be postponed until it is the only option left. Path dependence can in this environment be seen as a consequence of the local management not accepting the failure that a reshoring decision could be seen as being from the local host-market perspective.

If managers situated in different places can be thought to primarily hold experiential knowledge related to their experience of these places, the question and related assumptions of “who is deciding” is relevant as it raises the prospect that while headquarters may be deciding, it might not necessarily be the unit that is actually learning – at least not about the host market. While front line managers may be thought to skew towards stalling, or playing for time, hoping for a positive change, managers at headquarters might be keener to take a reshoring decision. This decision may be taken even though, or perhaps because, they do not have the same experiential knowledge. This, in turn, suggests that reshoring might be a decision driven by reasons besides knowledge and insight into the foreign market (thus unrelated to host-market specific risk) and more related to a corporate-level strategic risk management, where the risk is more associated with lack of control, or necessity of tighter coordination of the value chain. Thus, while local management may skew towards having a higher risk tolerance, headquarters can be thought to skew towards a lower risk tolerance.

Although all assumptions in relation to who is learning and deciding discussed here are critical for each of our four propositions, as depending on “who” learns or decides we might have different effects on the likelihood of reshoring, we decided to leave these aspects simply as a final note to our discussion and avoid postulating sub-propositions. In fact, the assumptions about who is learning and who is deciding clearly would further refine each of the propositions and future empirical testing might reveal the different effects we may expect from situations of dispersed versus concentrated knowledge within the organization, of single decision makers versus multiple decision makers, and of cases in which decision-making rights and knowledge do not reside with the same individuals.

Conclusions, managerial relevance and future research
We conclude that our understanding of reshoring can be greatly enriched by considering the effects of risk contingencies on a firm’s commitment to a particular market. Framing reshoring as a question of risk management that can be explained on behavioural grounds,
this paper postulates four propositions about when reshoring decisions are likely to be made. These propositions, in turn, are based on the reasoning of the IP model but also expand on this reasoning in light of the particular circumstances that the potential decision of reshoring presents. Finally, we provide arguments for distinguishing reshoring executed in a complex context of uncertainty and risk compared to a context of easily calculated economic benefit. When considering the extant literature on manufacturing reshoring, the risk management perspective proposed in this article offers a relevant contribution allowing researchers to overpass the dichotomous conceptualization of such a phenomenon as either a correction of an earlier managerial mistake (Kinkel and Maloca, 2009) or a response to changes in the external environment in the offshoring and/or home-country (Martínez-Mora and Merino, 2014). Moreover, the development of the “likelihood of reshoring” concept permits addressing one of the future research avenues proposed by Bals et al. (2016). More specifically it allows the development of frameworks to assess firms’ “reshoring readiness”, which is their “ability to handle the eventual outcomes of their [reshoring and insourcing] decisions, whatever these may be” (Bals et al., 2016, p. 112). This ability is ultimately connected to the managers’ risk perception.

This paper makes several contributions to IB research by presenting a theoretical framework for understanding reshoring as a risk-management decision. More specifically, it introduces the logic of the IP model to ongoing discussions in research on reshoring and, in doing so, provides support to the view of reshoring as a non-linear IP. This paper complements the predominantly economic logic and thinking around reshoring from a behavioural perspective. More specifically, in introducing this framework, this paper has defined three kinds of risk associated with reshoring: host-country related risk, home-country related risk and reshoring-process specific risk. These risks are postulated to both affect reshoring decisions in different ways as well as sometimes cancel each other out as influences on a firm’s decision making. Together these add a novel dimension to research on reshoring as the current discussion mainly has considered reshoring in terms of rational motives rather than behavioural processes. Particularly, they highlight the potential managerial challenges in tackling the decision of reshoring, which here are portrayed as considerably more complex than the mostly economic factors that thus far have dominated the literature on reshoring. Moreover, the perspective outlined in this paper also brings to the fore assumptions about learning, knowledge, risk perception and decision-making (e.g. questions of “who is learning” (i.e. who has the knowledge to evaluate the reshoring decision) and “who is deciding”) that presently remains critically important and in need of further study. Finally, this paper suggests that the IP model can be used to understand how the IP may change into “reverse gear”, and in doing so, may cause reshoring; this aspect also contributes (similarly to the elaboration on risk in Figueira-de-Lemos et al., 2011) to further expanding our understanding of the IP model itself.

Managerial relevance
The overall reasoning put forth, although theoretical, highlights some key issues that have important managerial implications. First, managers must be aware that a decision of reshoring is not determined only by host-country factors. Managers are suggested to consider the “relational” level of risk between home-country and host-country, and they should also acknowledge the potential costs and challenges of the reshoring process per se (as an add-on to the risk related to the home-country) when evaluating the possibility to reshore. Consequently, managers should also be aware of the potential problems related to reshoring decisions that are based only on the (partial) knowledge of the
subsidiary or the headquarters. Managers in the home- and host-country are able to evaluate respectively each country’s risk levels, but, if the decision of reshoring has to reflect the relative risk level between two locations, it should incorporate knowledge from both contexts, and consequently involved managers from both locations (i.e. subsidiary and headquarters).

**Future research**

Finally, our work and overall reasoning in this paper suggest novel questions for future theoretical and empirical research. In particular, assumptions related to knowledge are key to the understanding of the decision of reshoring. One relevant aspect is the unit of analysis, i.e. who is learning or is really driving reshoring decisions? As has been extensively discussed in this paper, the reshoring decision can be explained as relying on the perceived risk in the host-country. However, we can at the same time suspect that this is not a purely local decision – suggesting that the learning and risk perception of headquarters also has a part in such decisions. Future research may therefore further investigate the assumptions related to knowledge in the context of different levels of decision-making about reshoring.

Moreover, and turning our focus to the assumptions of knowledge in the IP model, we realize that reshoring could be both a decision based on new knowledge, which shows the benefit of reshoring, or a decision that is dictated by the lack of necessary knowledge, i.e. reshoring is seen as a safer option from a risk-management perspective. Consequently, we could also question for instance how realistic it is to assume that firms have the required knowledge of local market conditions to populate and use “decision tools”, as suggested in the reshoring literature (Gylling et al., 2015; Kinkel and Maloca, 2009). Considering that experiential knowledge of the local market is seen as critical for risk management, as well as particularly difficult to acquire, the usefulness of decision tools for risk reduction can be questioned from the perspective of firm’s knowledge and learning. In fact, a few reshoring studies have already pointed to cases where reshoring is a decision taken to correct previous commitment mistakes (Gray et al., 2013; Kinkel and Maloca, 2009), i.e. that a previous lack of market knowledge led to exposure to unforeseen risks. Taken together, this reasoning suggests that assumptions of bounded rationality are not always verified in the reshoring literature, raising important questions of what might happen to our understanding of reshoring if we, for example, instead assume that firms suffer from “sheer ignorance” – i.e. not knowing what they do not know and therefore cannot be assumed to make “roughly correct” risk-management decisions.

A number of important empirical questions also arise from the reasoning of this paper. First, are different loci of risks (home-country, host-country, reshoring-process specific risk) more or less salient in risk management decisions to reshore? Second, and on a related note, approaching risk as a driver of reshoring decisions and acknowledging the different loci of risk raises questions such as: How are different risks perceived by different actors, such as headquarters and subsidiaries? How might such differences in risk perceptions affect reshoring decisions? Are different actors more willing to carry risk than are other actors? Finally, reshoring as risk-management does not exist in a vacuum, which raises the question of how does risk management behaviour interface with traditional, economic drivers of reshoring? These questions, and others like them, will hopefully enliven the reshoring literature and provide additional fodder for research in the years to come as we open up reshoring in all its fascinating complexity.
Note

1. Clearly a firm that perceives increased risk in the host-country and also a high risk to reshore back home might look at another host-country as a relocation option. This would lead to a choice of further offshoring or near shoring (i.e., bringing operations to a much closer country than the current host-country), though these two last options are outside the scope of our reasoning and paper focus.

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