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An assessment of package–organisation misalignment: institutional and ontological structures

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Abstract

Even with today's 'best practice' software, commercial packages continue to pose significant alignment challenges for many organisations. This paper proposes a conceptual framework, based on institutional theory and systems ontology, to assess the misalignments between package functionality and organisational requirements. We suggest that these misalignments can arise from incompatibility in the externally imposed or voluntarily adopted structures embedded in the organisation and package, as well as differences in the way the meaning of organisational reality is ontologically represented in the deep or surface structure of packages. The synthesis of the institutional-ontological dimensions leads us to identify four types of misalignments with varying degrees of severity – imposed-deep, imposed-surface, voluntary-deep, and voluntary-surface – and to predict their likely resolution. We test the predictions using over 400 misalignments from package implementations at three different sites. The findings support the predictions: the majority of imposed-deep misalignments were resolved via package customisation. Imposed-surface and voluntary-deep misalignments were more often resolved via organisational adaptation and voluntary-surface misalignments were almost always resolved via organisational adaptation. The extent of project success also appeared to be influenced by the number of misalignments and the proportion of imposed-deep misalignments. We conclude by suggesting strategies that implementing organisations and package vendors may pursue.
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Introduction

Package–organisation fit has long been recognised as a major issue in the implementation of package software (Lucas *et al.*, 1988). This issue has become more salient in recent years with the widespread adoption of enterprise system (ES) packages, which include enterprise resource planning systems (ERPs), supply chain management systems, and customer relationship management systems. Despite the embedded 'best practice' processes and the large number of configurable parameters, many organisations still find there are important needs or expectations that are not met by these packages. A completely 'vanilla' implementation is often not feasible (e.g., Soh *et al.*, 2000; Light, 2005a, b; Wagner *et al.*, 2006).

As the growth of packaged software gains momentum, a key recognition is that ensuring package–organisation fit is becoming increasingly

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complex. Such negotiations are no longer direct, but are conducted at the market level (Sawyer, 2001). Direct involvement of organisational users, for example, is not common in packaged software development (Keil & Carmel, 1995). It is also difficult for packaged software developers to continually tweak their products to keep pace with changing industry requirements and to nuance their products for use by a range of customers (Light, 2005a, b). The weak customer–developer links suggest that package–organisation misalignments are inherent and inevitable, and will need to be properly addressed and resolved.

The issue will become even more pressing as the adoption of packaged software expands beyond U.S./Western European (the original development contexts) to Asia and Eastern Europe (e.g., Martinsons, 2004). There is thus a need to better understand the fundamental nature of package–organisation misalignments and to develop a more robust gap-fit analysis of the differences between package functionality and organisational needs (Sawyer, 2001). This paper seeks to provide a theoretically grounded framework for systematic assessment of the extent and severity of these misalignments and for understanding when customisation or organisational adaptation is more appropriate to resolve the misalignments.

We draw on institutional theory and systems ontology to answer three fundamental questions: (i) What are package–organisation misalignments? (ii) Why do package–organisation misalignments arise? (iii) When do organisations customise packages and when do they adapt to the packages instead? Institutional theory provides the insight that vendors, in developing packages, draw upon the institutional structures of the referent organisations with which they interact. Package–organisation misalignments arise when the institutional structures embedded in packages differ from those of the implementing organisations. Ontology, as a theory in modelling real-world systems, provides a structure to describe the nature of these misalignments. A synthesis of these two theories provides a 2 × 2 typology to predict the conditions under which organisations should customise or adapt to packages.

We then examined three organisations that implemented large-scale package software. The first is in the defence industry and the other two cases are in the healthcare industry. These case studies provide rich illustrations of the different types of misalignments. They also enable us to test our predictions that certain types of misalignments are more likely to require customisation.

The nature of package–organisation misalignment

In the following section, we examine the nature of package–organisation misalignment. We first draw on institutional theory to explain why package–organisation misalignments arise and suggest a view of misalignment based on institutional theory. We then draw on ontology to define the nature of package–organisation misalignments and similarly propose an ontological view of the misalignments. The typologies arising from the two views are synthesised in the subsequent section.

Institutional theory and package–organisation misalignments

Package software, as an IT artefact, is seen to embody structurational properties (DeSanctis & Poole, 1994). Gosain (2004), for example, noted that package systems such as ES are subject to institutional forces and institutional processes that set the rules of rationality. They are an important embodiment of institutional commitments and serve to bind organisations to fundamental choices about how organisational activities should be organised. Technology creators, including the developers of software, inscribe their vision or view of the world in the technology they create (Latour, 1992). The designers' view of the world is influenced by their own institutional context.

Soh & Sia (2004) noted that the institutional context that package developers attempt to represent is heavily influenced by their selected group of referent organisations. These referent organisations tend to be from the developers' home country or countries that are major target markets. The referent organisations also tend to be from specific industry segments. The institutional context of referent organisations, filtered through the developers' cognitive lenses, is embedded in the software through structures such as operating hierarchies, standard operating procedures, rules, and capabilities (DeSanctis & Poole, 1994).

Institutional theory recognises that institutional context can differ. Institutional structures develop cumulatively over time as organisations interact with their environment. Organisations in different environments (e.g., in different countries or industries) will develop different institutional structures. These structures are persistent because they serve to provide meaning and access to resources from the environment (DiMaggio & Powell, 1983).

Hence packages developed for one set of institutional contexts may not fit organisations operating in a different institutional context. There are many barriers that hinder a developer's ability to reflect an implementing organisation's institutional context. Usually, developers are separated from implementers in time and space (Orlikowski, 1992). Moreover, the taken-for-granted quality of institutional context adds to the challenges of identifying and communicating contextual differences.

Institutional theory makes an important distinction between imposed structures and voluntarily acquired structures (Scott, 1987) (see Table 1). The distinction is important because it determines the degree of volition that the implementing organisation has when package–organisation misalignments arise (Soh & Sia, 2004).

Table 1 Dimensions of context specificity

	Explanation	*Examples*
Imposed context		
Country specific	The unique socio-political system, economic structure, or cultural practices within a country.	Country regulations, policies, systems, practices, or norms, e.g., unique national identification numbers.
Industry specific	The unique practices specific to some industry or public sectors.	Industry norms for interacting with customers/suppliers/ regulators and in resource management, e.g., the more stringent accountability requirements, regulatory compliance and complex reporting procedures for public organisations or financial industry.
Voluntarily acquired context	The idiosyncratic organisational differences.	Differences in practices, processes, or operations due to services developed for niche markets, routine for managing critical resources, quests to enhance customer service, management risk tolerance, user preferences, etc.

Imposed structures are the result of external demands made on the organisation by authoritative sources such as government, professions (DiMaggio & Powell, 1983), and established industry practice. An imposed structure misalignment may arise, for example, when the tax reporting structures built into the package do not fit the tax compliance requirements of the implementing organisation. Voluntary structures are those where organisations have a higher degree of choice in their creation of structures (Oliver, 1991). These would include structures that organisations develop as a result of their history and experience, strategy, and management preferences. Voluntary structure misalignments may arise, for example, if the implementing organisation's structures reflect very low-risk tolerance, while those embedded in the package assume a higher level of risk tolerance. The package may not have the granularity of control to which the implementing organisation is accustomed.

Our application of institutional theory explains that package–organisation misalignments arise because of differences in the institutional context assumed by developers and that of implementing organisations. The theory also distinguishes between imposed and voluntary structures that determine the implementing organisation's leeway in responding to the misalignments. Institutional theory, however, does not discuss how the institutional reality is captured and embedded into an information system. Ontology thus provides a complementary perspective to investigate misalignments, as some issues are not about mismatches in the institutional reality but, rather, how the meaning of reality is captured and represented in the package software.

Ontology and package–organisation misalignment

Ontology is a well-established domain within philosophy dealing with models of reality. Wand & Weber (2002, p. 365) defined it as 'a theory that articulates those constructs needed to describe the structure and behaviour of the world in general'. It is useful as a theoretical foundation for knowledge representation and modelling of information systems. In information systems research, the Bunge–Wand–Weber (BWW) ontological model[1] is widely applied (e.g., Wand & Weber, 1990; Heales, 2000; Green & Rosemann, 2000). Table 2 presents the key constructs in the representational model.

BWW ontology is highly formalised and has been developed specifically to represent information systems. Prior researchers have employed the BWW ontological model as the theoretical foundation for evaluating systems analysis modelling techniques such as data flow diagrams, entity relationship diagrams, object-oriented schemas, and process modelling grammars, highlighting theoretical instances of ontological incompleteness and deficiencies (Green & Rosemann, 2000; Soffer *et al.*, 2001).

We extend the application of the BWW ontology to the analysis of package–organisation misalignments. Packages, like all application software, carry their representation of the meaning of the real-world systems through their ontological structures. Wand & Weber (1990) argue that for an information system to be stable, its structure must represent a 'good' mapping to the real world it seeks to model. From an ontology perspective, therefore, misalignments are instances where aspects of the real world are not adequately represented by the model embedded in the package.[2] The BWW ontology

[1] The BWW ontology comprises the representation model, the state-tracking model, and the decomposition model. Consistent with prior work, we have relied largely on the representation model, as it is most theoretically relevant.

[2] We focus our analysis of misalignment on system deficits since system excesses are generally not regarded as a problem (where available system features exceed the organizational requirements).

Table 2 Elements of ontological structure

Ontological construct	*Explanation*	*Examples*
Core deep structure elements		
Thing (DT)*	A thing is the elementary unit in the BWW ontological model. The real world is made up of things. The things can be concrete or conceptual.	An inventory item, a customer order, a customer account, a customer repayment, an inventory replenishment, a supplier account.
Property (DP)*	Properties must always be attached to things.	
Property	A property that is inherently a property of an individual thing is called an intrinsic property.	Inventory number, quantity on hand, unit price (for an inventory item), order number, customer number, item number, quantity ordered, sales prices, sales amount, date (for a customer order).
Relationship	A property that is meaningful only in the context of two or more things is called a mutual or relational property, e.g., 'is part of', 'interaction connection'. Other ontological representation includes class and composite thing.	Customer account is related to customer order and customer repayment. Supplier account is related to inventory replenishment.
State (DS)*	Vector of values for all property functions of a thing.	
Conceivable state	The set of all combinations of values that a thing might assume.	Status of production order (planned, released, active, completed, closed, held, cancelled). Acceptable range of values.
Lawful state	Laws reflect either natural or artificial structural constraints imposed upon things. Usually a proper subset of the conceivable state space.	
Transformation (DTx)*	Mapping from a domain comprising states to a co-domain comprising states.	
Conceivable transform	The set of all combinations of values.	Rules for production planning, execution, and control. Calculation of production cost. Rules for posting to inventory and order closing.
Lawful transform	Laws reflects some rules of dynamics on stimulus–response, transition, and derivation.	
Surface structure		
Information access (SA) Input interface (SI) Presentation format (SP) Report output (SO)	Interface between information systems and its users.	More refined access, establishing automatic screen flow, defaulting input parameter, presentation design of interactive screen, format of order document, content of production report, missing costing report.

*Core Ontological Element

provides a set of dimensions for assessing the nature of these package–organisation misalignments.

These dimensions flow from the key distinction between deep and surface representations of reality (Wand & Weber, 1990; Weber, 1997). Deep structure conveys the core meaning of the real-world system that the information system is intended to model. The real world is made up of *things* (e.g., atoms, fields, persons, artefacts, and social systems) and these things possess *properties* (e.g., characteristics always attached to things) existing at certain *states* (e.g., conceivable and lawful ranges of values). The states of things change through *transformations* (i.e., business rules or laws that define allowable operations). An accounting system, for example, in representing bank and debtors accounts, their properties (e.g., current or saving accounts, transaction currencies), states (e.g., outstanding amounts or balances), and transformations (e.g., in the rules for ledger posting), reflects deep-structure characteristics as it indicates how the wealth of certain organisations and individuals in the real world alters as economic contracts are exchanged and executed (Wand & Weber, 1990).

These deep structural elements of things, properties, states, and transformations are considered core, as the absence of such elements always lead to major system deficiencies. For example, a system's inability to relate one thing to another can be traced to a missing property that links the two things. Similarly, a system's inability to reflect the occurrence of an event may be traced to a

missing transformation that changes things from one state to another. Deep-structure package–organisation misalignments thus occur when real-world things, properties, states, and transformations are missing or incorrectly represented in the system.

Surface structure, on the other hand, is concerned with how real-world meanings are conveyed through the interface between the information system and its users (e.g., interactive dialogue and report format). Surface-structure misalignments arise when the way that users in the real world access information, input information, and view information on screen and in hardcopy reports differs from the interface provided by the package. For example, customer service officers may need to see information about a client's current transaction as well as summary information on past transactions on the same screen when interacting with the client. The package screen interfaces, however, may be designed so that the information is spread across several different screens, making it unwieldy for these officers.

Ontological theory therefore suggests that there are fundamentally two types of package–organisation misalignments: deep-structure misalignments and surface-structure misalignments.

Package customisation or organisational adaptation?

When misalignments arise after the selection of package software, organisations have two major options: They can either adapt to the package or they can customise the package. Organisational adaptation will require changes in organisational processes, policies, structures, and/or roles. In some instances, the adaptation will be relatively minor – for example, users may need to perform an additional processing step or accept a different report format. In other instances, the adaptation may be significant – for example, the organisation may need to change its departmental structure to accommodate the more cross-functional structure of the package. Package customisation involves changing the source code, making modifications that are maintained in a separate directory, installing extensions through user exits, and using report writers to modify and embed new screens and reports. Generally, customisation is strongly discouraged, as it is costly (development effort) and increases the risks of the implementation (introducing bugs into the programme, adding complexity, making integration more difficult), as well as the risks and costs of future upgrades.

The advice to pursue a 'vanilla' implementation works well in a situation where there is a high degree of package–organisation alignment. Institutional theory, however, suggests that organisations in countries and industries other than those envisioned by the package developers will often discover many instances of package–organisation misalignment. This will occur with increasing frequency as the emerging economies in Asia and Eastern Europe adopt packages developed largely for the United States and Western Europe. Pursuing a 'vanilla' implementation in such instances will result in significant changes to the processes, structures, roles, and policies of the implementing organisations. Some of these changes may adversely affect operational efficiencies and may even undermine the organisation's customer service and competitiveness.

For these organisations, finding a way to distinguish the degrees of severity among the many instances of misalignments and to discern the preferred way of handling each case would be helpful. We argue that both institutional and ontology theories shed light on this issue by suggesting that the different type of misalignments vary in terms of their severity to an organisation.

Typology of package–organisation misalignment

The application of institutional theory to package–organisation misalignments leads us to identify two different types of misalignments: imposed and voluntary. Typically, misfits that arise from imposed structures are less malleable, as organisations have little ability to change the country laws and regulations or industry norms. In addition, non-compliance can lead to dire consequences, such as formal or informal sanctions from regulatory authorities or partners. On the other hand, for voluntary structure misfits, organisations have a certain leeway in which to compromise their expectations or adapt their internal processes. Organisations may be able to adjust reporting structures, transactional processes, and management expectations in order to resolve misalignments arising from their sub-contexts (e.g., departmental, group, or individual practices), but they are seldom able to modify or influence the imposed structure in the supra-contexts in which they are situated.

Similarly, the application of ontology leads us to identify two types of misalignment: deep structure and surface structure. Deep-structure misalignments are more severe because they represent an incompatibility in the fundamental structure of the reality. Missing or incomplete representation of these elementary units of reality in information systems can have widespread implications. Missing key entities ('things') or important business rules ('transformations') directly affect system capabilities in transaction processing to reflect changes in the real world. Such effects are often pervasive, as they also permeate to the surface structure, for example, management reports or screen presentation.

On the other hand, surface structure misfits are relatively benign, typically relating to issues of convenience and presentation preferences. Examples include misfits in input interface, presentation format, reporting requirement, or information access. Surface structures can often be changed without changing the deep structure of an information system. For example, the user interface may be modified or the data can be exported to another application for manipulation with no effect on the meaning of the information processing carried out in the system (Wand & Weber, 1990).

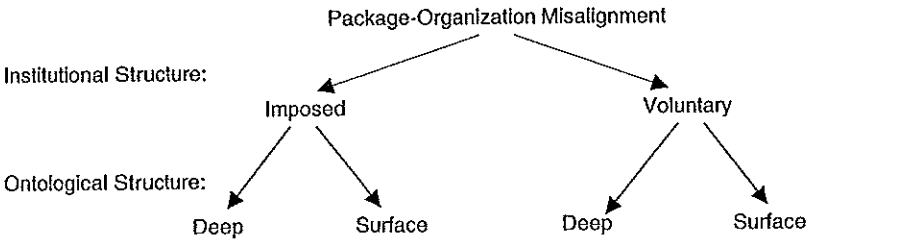
Integrating the institutional and ontological perspectives, we present a framework (see Table 3) that identifies four types of misalignments, some more severe than others, with different likelihoods of customisation.

Imposed-deep misalignments typically reflect the failures of ES systems in capturing key elements of reality (e.g., missing or inappropriate things, events, properties, states, or transformations), directly impacting an organisation's operating capability. Moreover, little can be done to compromise or do away with the requirement, given its externally mandated context. An example is the misalignment noted by Martinsons (2004) in implementing commercial ERPs in the state-owned enterprises in China. The differences in resource allocation models (i.e., decentralised *vs* the entrenched centralised system) inflict heavily on the deep structure of information systems (i.e., different things, properties, states, and transformations). Similarly, the failure of SAP implementation by Fox Meyer could also be partly attributed to critical mismatches between an early ERP system designed largely for manufacturing companies and its implementation in a wholesale business. The system did not model the events and transformation rules for the industry practice (imposed structure) where wholesale intermediaries source from many suppliers in order to fill a customer's order quickly, break orders into multiple shipments, and invoice incomplete shipments. The ensuing confusion resulted in the loss of millions of dollars for Fox Meyer. Given the inability of the organisation to change the imposed context and the severe consequences of not conforming to country or industry practice, most imposed-deep misalignments are likely to result in package customisation.

Imposed-surface misalignments are less severe, given the limited impacts of surface structure misalignments and the relative ease of alternative workarounds. But the non-negotiable external requirements from imposed context preclude the option of changing organisational requirements in order to conform to the package. Specifically, when the transaction volume is high, the inconvenience and compromise of user preferences can stretch the organisation's limit of tolerance. Reimers (2003) noted a few such instances in the implementation of ERP for Gearbox (China) Ltd.: 'the format of printed invoices had to be adapted to Chinese financial regulations (China's generally accepted accounting and financial standards); similarly, the radix and the thousand points in numerical data fields had to be changed since, in Germany, a comma is used as a symbol for radix while a dot is used to indicate the thousand point whereas in China usage is the other way round' (p. 1088). While such misalignments do not affect real business operation, the surface structure incompatibility with country requirements or industry norms could still cause substantial confusion and frustration. While the organisation does not have the option to ignore the imposed structure, the decision on whether to customise should weigh the costs of customisation against the frequency and volume of workaround efforts needed to meet the externally imposed requirement.

Voluntary-deep misalignments relate to the deep ontological elements of the reality and to aspects of organisational context that are more malleable. Although organisations can modify the existing status quo (voluntary structure), such changes sometimes necessitate compromising key strategic thrusts and substantial effort in managing the change of institutionalised practices. Hershey, for example, had evolved its own organisation-specific routines for managing its storage resources to deal with the cyclical demand for candy (e.g., Halloween). It hired temporary storage facilities and also converted rooms in its manufacturing premises for

Table 3 Institutional and ontological structure assessment framework



Imposed-Deep	Imposed-Surface	Voluntary-Deep	Voluntary-Surface
Missing or inappropriate thing, property, state, or transformation arising from different country or industry assumptions	Missing or inappropriate access, input, presentation, or output arising from different country or industry assumptions	Missing or inappropriate thing, property, state, or transformation arising from organization-specific assumptions	Missing or inappropriate access, input, presentation, or output arising from organization-specific assumptions

storage. The implementation of an ERP package cost Hershey $150 million in lost sales because the temporary storage locations were not recorded as storage entities in the ERP's data model. Hershey lost track of its inventory so badly that it could not fulfil many orders. Similarly, Nike foresaw the problem of such voluntary-deep misalignments in its implementation of ERP. It decided not to adopt the package's pre-configured industry logistic module, as it felt that the embedded model was not well-aligned with Nike's unique global network of suppliers that were integrated via a private marketplace (Ericson, 2001). For voluntary-deep misalignments, while organisations have the option to adapt to the package, the decision to do so must be carefully weighed against the possible impairment on these organisations' ability to execute their strategies.

Voluntary-surface misalignments are relatively mild because they do not relate to fundamental aspects of real-world representation and organisations also have greater discretion in adapting its internal structure, processes, and business requirements to align with embedded practices in the package. Examples of such misalignments include management requests for specific reporting formats and user complaints regarding system interfaces. Such surface structure problems, though irritating, could often be accepted as something that the organisations will gradually get used to, without the implications of industry sanction or regulatory breaches arising from externally imposed structures. Voluntary-surface misalignments therefore usually lead to organisational adaptation.

By assessing the institutional and ontological structures, the framework offers a theoretical basis to discriminate the severity of specific instances of package–organisation misalignments. Misalignments are likely to have a more severe impact on organisations when the key elements of reality are externally mandated (imposed structure) and the core design of the package software fails to appropriately represent such elements (deep structure).

While the framework seeks to provide a basis for dealing with misalignments, in reality the resolution of these package–organisation misalignments is a negotiated outcome among users, managers, IT personnel, and vendors. Nonetheless, amidst the disparate perceptions/views of these stakeholders, it is easier to sustain a customisation argument for imposed-deep misalignments *vs* others. Customisation justifications for imposed-deep misalignments can appeal to the fact of external regulation or established industry practice, as well as the difficulty of working around a missing deep structure element. It is much more difficult for the interested party to argue for customisation for voluntary-surface misalignments. In the absence of externally mandated requirement, coupled with the less fundamental nature of the misalignment, counter-arguments for organisational adaptation are more likely to hold sway. Organisations therefore are most likely to customise imposed-deep misalignments and are most likely to adapt to voluntary-surface misalignments. Imposed-surface and voluntary-deep misalignments lie between these two extremes.

Methods

We examined the phenomenon of package–organisation misalignment in three Singapore organisations: a defence organisation (DEF_CO) and two public hospitals (Hospital A and Hospital B). These organisations were implementing enterprise-wide package software.

Case background

DEF_CO implemented an enterprise e-procurement solution, spanning the end-to-end workflow from raising a purchase requisition, selecting catalogued products, and delivering goods to paying vendors. The combined potential number of users across the military bases was about 6000 with an annual transaction volume of at least $60 million. Using the relatively mature Ariba e-procurement package, the $14 million system comprised an intranet-based procurement system and an internet-based business-to-business (B2B) gateway to facilitate end-to-end connectivity with its suppliers and trading partners. The Ariba package included Ariba Buyer, Sourcing, and Marketplace modules. The project kicked off in July 2002 and was completed within one and a half years. The main objective was to achieve higher efficiency and cost/time savings for the organisation through process standardisation and tighter integration across the enterprise.

Hospital A was a large public hospital with about 1500 beds. It had a long-established history as a teaching hospital with depth of expertise in multiple specialties. Hospital A sought to avoid the Y2K problems by replacing their legacy systems in finance and patient management with an ERP package. In doing so, they became an early adopter of the package within their industry in Singapore.

Hospital B was a smaller public hospital with about 800 beds. It was over a hundred years old and had always focused on treating women and children. The hospital also sought to pre-empt Y2K problems by replacing its legacy systems in finance and patient care with an ERP package. Like Hospital A, it selected the same market-leading ERP package. It began its implementation a year after Hospital A and was able to benefit from some of the vendors' localisation of the package.

The cases were selected with both theoretical replication and variation in mind (Yin, 2003). With regard to theoretical replication, all three cases involved large-scale package implementation, ranging from $10 million to $14 million in contract value. Each project spanned about 20–30 months. The two hospital cases also provided theoretical replication on the institutional dimension, as they were both in the same industry and adopting the same package. This similarity enabled us to identify the imposed institutional contexts more clearly. Theoretical variation was obtained by examining

different types of packages (procurement, healthcare ERP) with varying maturity, different industries (defence and healthcare), and different organisations (providing variance in the voluntary structures, e.g., different history and market positioning). The variation strengthened our ability to assess whether the predicted patterns of customisation *vs* organisational adaptation were observed regardless of package, industry, or organisation.

Data collection

Package–organisation misalignments were the basic unit of analysis in this study. The misalignments were identified from requests for change (RFCs) documentation in each project. These RFCs were either spelt out in the implementation contracts or raised and approved through the formal change request process during implementation (up to 3 months after rollout). As they were formally reviewed by users and consultants, the RFCs were scoped out and defined in reasonable detail. The focus on formal RFCs allowed us to exclude trivial misalignments raised (e.g., in minutes of meetings). Each unit of analysis was discrete, with one distinct ontological dimension and one institutional dimension. Occasionally, there were lengthy RFCs with multiple ontological or institutional aspects. We parsed these into separate instances of misalignment. For example, one RFC related to bed-class functionality (arising from imposed structure) and comprised two distinct misalignments: one regarding the need to incorporate subsidy computation (deep structure transformation) and another for the generation of specific bed-class reports for Ministry of Health submission (surface structure output).

For each site, we were in the field for 3–6 months reviewing documentation (e.g., contracts, project files, minutes of meetings, and issue logs) and interviewing key players (15–20 project team members per site, comprising user representatives, IT personnel, and consultants). Through these sources, we also tracked the resolution for each misalignment. Follow-up visits or telephone calls were made where necessary to clarify the context of change requests and the rationale for their resolution. We also consciously acquired knowledge about the packages implemented and the relevant industry and country contexts in defence and healthcare.

Coding of institutional structure

Coding was performed independently by two researchers. The researchers went through the misalignments to code the contexts from which the institutional structures arose. The coding followed a decision tree structure. We first explored the imposed context by analysing the country requirement, that is, was the unique requirement pervasive – also applicable to other organisations in Singapore? We then examined the industry requirement, that is, was the requirement pervasive – also applicable to other organisations in the same sector or industry? Failing the above criteria, we would consider the misalignments to arise out of specific responses voluntarily adopted by organisations (e.g., to differentiate themselves in the marketplace or to cater to the localised preferences of particular user groups). Some of these organisation-specific misalignments related to core issues, for example, management structure, product differentiation, or business strategy, while others were less pervasive, often arising at the sub-organisational level (e.g., specific departmental, functional, managers, or user requests).

The coding of the institutional context was challenging and demanded in-depth business domain knowledge and an understanding of the local institutional norms or industry requirements. Coding inconsistencies between raters were reconciled through further dialogue and interviews with the respective personnel as well as secondary research on information about the healthcare/defence industry. The kappa coefficients for inter-rater coding on institutional structures were acceptable at 0.82, 0.72, and 0.75, respectively.

Coding of ontological structure

The identified misalignments were then coded in terms of ontological structure, following the ontological dimensions noted in Table 2. Each misalignment was analysed to determine if it was related to missing or inappropriate entities (DT, i.e., Deep structure–Thing). If not, the coder would then consider if it was due to missing or inappropriate fields of an entity, moving systematically from mutual property or relationship (DP, i.e., Deep structure–Property), inconceivable or unlawful value range (DS, i.e., Deep structure–State), and inadequate or invalid functionality or transformation rules (DTx). If the misalignment could not be assigned to one of these deep structure categories, the coder would then categorise it as relating to surface structure and sub-code it as one of the following: inappropriate information access (SA, i.e., Surface structure–Access), input interface (SI, i.e., Surface structure–Input), presentation format (SP, i.e., Surface structure–Presentation), or report output (SO, i.e., Surface structure–Output). The analysis at the sub-ontological dimensions[3] was useful, as it provided us greater confidence in categorising a misalignment as relating to deep or surface structure.

The coding results were reconciled between the two researchers. Inconsistencies, largely due to inadequate descriptions and different understanding of the misalignments, were discussed and followed up with the appropriate personnel or consultants. The kappa coefficients

[3] Even though Rosemann *et al.* (2004) have explored the more refined conceptual notion of 'ontological distance', we found it sufficient simply to distinguish between deep and surface structure. Analysis at this higher level also helps us to get around the problem of detailed operationalisation as many of the sub-constructs have been criticised to be imprecisely defined, as indicated in the general lack of empirical validation for ontology work.

for inter-rater reliability were 0.86, 0.88, and 0.78 for the respective sites.

Results

We found over 400 instances of misalignments. In the following sections, we first describe representative examples of each type of misalignment from the different case organisations and highlight the institutional and ontological dimensions. We then analyse the patterns of misalignments across organisations and the pattern of customisation *vs* organisational adaptation for each type of misalignment.

Types of misalignments

Imposed-deep misalignments The package in DEF_CO lacked the functionality for public sector fund management. Specifically, the package did not support the commitment of funds prior to purchases. Financial budgeting controls by the Ministry of Finance required that all purchases be drawn from pools of funds pre-committed for specific purposes. Sufficient funds had to be available prior to drawdown. This financial budgeting practice was mandatory and deeply entrenched in the public sector. Ontologically, this misalignment was a missing 'transformation' as the package could not account for the movement or drawdown in the committed funds.

Similarly, the unique healthcare funding practices in Singapore resulted in a number of imposed-deep misalignments for Hospitals A and B. The package did not have the functionality to handle the patient billing and government subsidy computations for the different bed-classes (A, B, or C). Patients in the A bed-class (one or two beds per room) had to pay the highest bed charges, whilst those in the C bed-class (six or more beds in a room) had the lowest bed charges. The hospitals also received lower subsidy for bed and treatment fees for A bed-class patients. The institutional context was imposed, as the computation was mandatory in order for the public hospitals to claim subsidy from the Ministry of Health. Ontologically, the misalignment was deep, as a new set of business logic rules for subsidy computation ('transformation') had to be embedded within the billing program.

Imposed-surface misalignments In DEF_CO, stringent security required ensuring non-disclosure of sensitive information when sending out purchase orders. The outbound attachment functionality in the package's self-service procurement process raised security concerns, as users might inadvertently send out sensitive internal documents to external parties. DEF_CO requested that a warning message be presented upon activation of the attachment function. Institutionally, the customisation was imposed in order to comply with military security policy. Imposed structures sometimes contributed simultaneously to both the deep and surface misalignments. For example, in the two hospital cases, the country's bed-class subsidy policy required reports by bed class for submission to the Ministry of Health. Ontologically, the message display was a surface misalignment.

Voluntary-deep misalignments Voluntary-deep misalignments related to internal business practices that had evolved over time. One example in Hospital A was the inability of the package to accommodate its 'double decking' bed utilisation routine. A patient's bed might be temporarily allocated to another short-stay patient, while the first patient was in transit for check-ups or procedures in other specialty wards. The package's database setup did not allow for such double-decking of patients. Institutionally, double decking was not mandated but had evolved internally as a unique organisational practice to maximise bed availability. Hospital A had complex bed management practices because its large number of medical specialties demanded a high level of bed allocation efficiency. Ontologically, the misalignment was deep, given the incompatible relationship specification (i.e., the package's 1:1 patient–bed relationship *vs* the hospital's M:M patient–bed relationship).

Other voluntary-deep misalignments were attributed to specific market positioning. For example, Hospital B was positioned as a women's and children's hospital. The package was unable to account for the relationship between newborn babies and mothers in the maternity wards. The package represented the babies as sub-attributes of mothers in the data model. However, for situations where babies had to be warded, new patient records had to be created and maintained for the baby. The system could not link the mother and child patient records for billing, insurance claim, or other purposes. Institutionally, Hospital B wanted the functionality because it had a large number of such cases due to its specific market focus. Lack of such functionality would impair its quality of customer service. Hospital A, on the other hand, chose to live with this misalignment, because it was a general hospital and had fewer cases of this nature. Ontologically, the inability to link the two mother and child patients was due to a missing deep structure – the mutual property that both shared.

Voluntary-surface misalignments Sometimes, voluntary-deep misalignments were also manifested in the surface structure. For example, Hospital A required more detailed bed management reports, while Hospital B required the printing of premature baby labels. Other voluntary-surface misalignments were more idiosyncratic and were raised by various individuals or user groups. They were typically related to issues of management reporting, internal control preferences, and ease of use. Examples include the suppression of inactive fields, warning error messages, and audit trail reports.

In the following section, we present the overall pattern of misalignments across the three cases.

Pattern of misalignments

Tables 4–6 present the distribution of misalignments for each case. DEF-CO had 80 misalignments for the implementation of its e-procurement package. Hospital A had 218 misalignments for its ERP package, while Hospital B had 106 misalignments. The lower number of misalignments in Hospital B relative to Hospital A is because the former implemented the package a year later. The vendor had by then incorporated some of the country- and industry-specific requirements into the package.

Although the number of misalignments varies, the proportions of the misalignments for each category were relatively similar across the three cases. Imposed-deep misalignments (16–35%) displayed the highest degree of variance across the three cases. Specifically, Hospital A had an unusually high proportion of this type of misalignment, as it was an early adopter of the package in the specific country–industry context. Much of the package had not yet been localised. Hospital B, which implemented the package a year later, had fewer problems. Similarly, DEF_CO had fewer of their misalignments in the imposed-deep category because the procurement package that was implemented was relatively mature.

Table 4 Overall misfit findings in DEF_CO

	Deep structure	*Surface structure*	*Total*
Imposed structure	16 (20%)	11 (14%)	27 (34%)
Voluntarily acquired structure	19 (24%)	34 (43%)	53 (66%)
Total	35 (44%)	45 (56%)	80 (100%)

Table 5 Overall misfit findings in Hospital A

	Deep structure	*Surface structure*	*Total*
Imposed structure	76 (35%)	7 (3%)	83 (38%)
Voluntarily acquired structure	61 (28%)	74 (34%)	135 (62%)
Total	137 (63%)	81 (37%)	218 (100%)

Table 6 Overall misfit findings in Hospital B

	Deep structure	*Surface structure*	*Total*
Imposed structure	17 (16%)	15 (14%)	32 (30%)
Voluntarily acquired structure	28 (26%)	46 (44%)	74 (70%)
Total	45 (42%)	61 (58%)	106 (100%)

Imposed-surface misalignments were the least prevalent (3–14%). While there might be imposed-deep misalignments, their surface structure requirements (e.g., reporting) might not always be mandated. For example, there were requirements from the Ministry of Health to monitor infectious disease but the reporting format was not specified. The lower proportion of imposed-surface misalignments could also be a reflection of the tendency for organisations to prioritise imposed-deep misalignments over surface structure misalignments. This was particularly true when an organisation had to deal with a large number of imposed-deep misalignments. In Hospital A, for example, project resources were focused on the many imposed-deep misalignments and hence the imposed-surface misalignments accounted for only 3% of the total misalignments.

Voluntary-deep misalignments, on the other hand, accounted for a consistent proportion (24–28%) across the three cases. Organisational specificity was seemingly inherent across organisations, as each maintained a certain level of differentiation in the market.

Hospital A, being a multi-specialty hospital, had a large number of users, across many diverse medical specialties (cardiology, neurology, orthopaedics, paediatrics, geriatrics, etc.). Over time, it had developed a repertoire of structures and practices to manage the various competing demands of the many specialties. Similarly, Hospital B (with its main focus on the women's and children's market) and DEF_CO (with the low risk tolerance of senior management) had developed their own organisation-specific practices that were not in alignment with those in the packages.

Voluntary-surface misalignments were the most prevalent (34–44%). Many were related to surface output (14–33%) issues, followed by surface presentation (8–18%), and then surface input (1–15%) misalignments. Surface access misalignments constituted only about 5%. This was in part due to the wide enterprise deployment of the packages, as a large number of departments and individuals were affected. Each department had different operating procedures or business practices. Managers had different risk tolerances and wanted a variety of report formats. Users had different preferences for data input or screen presentation. The prevalence of such voluntary-surface misalignments in ES implementation was therefore expected. The variation across organisations could again be a reflection of the change request prioritisation of imposed-deep misalignments over the surface structure misalignments. Organisations implementing more mature packages (e.g., DEF_CO and Hospital B) seemed to have more resources for attending to such voluntary-surface misalignments and hence had a larger proportion of these.

Pattern of customisation *vs* adaptation by type of misalignment

In keeping with prescriptions from the literature, project managers in all three cases sought to keep package

customisation at a reasonable level. DEF_CO spent about 5% of the total contract value on package customisation. Hospital A spent about 10% of the contract value on customisation. The amount excluded some customisations borne by the package vendor as part of their localisation efforts. Hospital B spent about 8% of the contract value on customisation.

Our theoretical development of the typology suggested that the most severe misalignments (imposed-deep) should result in package customisation, while the least severe (voluntary-surface) should usually be resolved through organisational adaptation. The results across the three cases are consistent with these arguments. Tables 7–9 present patterns of misalignment resolution for the respective organisations.

Overall, the proportion of total misalignments customised across the three cases ranged from 36 to 45%. In addition, there was a high degree of consistency across the three cases in the pattern of customisation by type of misalignment. The majority of imposed-deep misalignments were customised (88–92%), consistent with our argument that the combination of externally imposed requirements and missing or inappropriate deep structure results in severe misalignments that require package customisation.

Table 7 Percentages of misfits customised in DEF_CO

	Deep structure	*Surface structure*	*Total*
Imposed structure	14/16 (88%)	5/11 (45%)	19/27 (70%)
Voluntarily acquired structure	7/19 (37%)	5/34 (15%)	12/53 (23%)
Total	21/35 (60%)	10/45 (22%)	31/80 (39%)

Table 8 Percentages of Misfits customised in Hospital A

	Deep structure	*Surface structure*	*Total*
Imposed structure	70/76 (92%)	3/7(43%)	73/83 (88%)
Voluntarily acquired structure	18/61 (30%)	6/74 (8%)	24/135 (18%)
Total	88/137 (64%)	9/81 (11%)	97/218 (45%)

Table 9 Percentages of misfits customised in Hospital B

	Deep structure	*Surface structure*	*Total*
Imposed structure	15/17 (88%)	6/15 (40%)	21/32 (66%)
Voluntarily acquired structure	11/28 (39%)	6/46 (13%)	17/74 (23%)
Total	26/45 (58%)	12/61 (20%)	38/106 (36%)

About 40–45% of the imposed-surface misalignments were customised. While these arise from externally imposed requirements as well, the surface structure makes them less severe than the imposed-deep misalignments. Our analysis revealed that although most regulatory or mandatory contexts spell out statutory reporting requirements, it was not necessary to customise all such misalignments unless the transaction volumes were high with frequent reporting or the data preparation efforts required were heavy and cumbersome. Some of these misalignments that did not result in customisation were addressed through the available reporting tools.

A total of 30–39% of voluntary-deep misalignments were customised. As these are voluntary in nature, organisations theoretically had the option of adapting to the package. Our analysis of these misalignments across the cases, however, showed that organisations usually chose to customise the package for the subset of voluntary-deep misalignments that related to the organisation's strategic positioning. This included Hospital A's need for double-decking beds to support its multi-specialty positioning, Hospital B's need for mother–child linkage to support its women's and children's market focus, and DEF_CO's need for additional controls consistent with its risk-averse management.

Only a small percentage of voluntary-surface misalignments were customised (8–15%). Among them were surface misalignments that had similarly affected an organisation's strategic positioning, for example, the lack of double-decking bed management report. The bases for the other voluntary-surface misalignments were, however, often *ad hoc* and inconsistent 'because someone or some departments wanted them' and typically that someone was an individual in a senior-managerial position. For example, in Hospital A, a project team member noted that several internal financial reporting misalignments were customised because the finance manager had the 'loudest voice' and 'won' the negotiations on the resolution of these misalignments. When we revisited the site some time after the implementation, a new finance manager had taken over and the previously customised reports were no longer in use. The new finance manager preferred the package's standard reports.

Discussion

Overall, the findings validated the predictions from the framework. The majority of imposed-deep misalignments were resolved via package customisation. Imposed-surface and voluntary-deep misalignments were more often resolved via organisational adaptation and voluntary-surface misalignments are almost always resolved via organisational adaptation. Several interesting issues also arose from these empirical findings. First, variations in the total number of misalignments as well as in the proportion of imposed-deep misalignments raised the question of how these affected project success. Second, the significance of imposed-deep misalignments also begged for deeper discussion with regard to both the

institutional and ontological perspectives, that is, questions about the dynamic nature of imposed structure and whether there were specific aspects of deep structure that were more difficult for package software to capture.

Imposed-deep misalignments and project success

While all three projects rolled out on schedule and without significant budget overruns, there were differences in user satisfaction and in the impact on service levels. Hospital A clearly had the most difficult experience. The higher number of misalignments and larger proportion of imposed-deep misalignments amplified the difficulties experienced during the project. The project resources and management attention expended on the imposed-deep misalignments and customisation resulted in testing and user training being cut back substantially. This in turn led to a variety of problems during systems rollout. For example, the lack of user familiarity with the system contributed to frequent data input errors. The problems encountered during the rollout stretched on for at least another six months.

In addition, customisation often did not address the severity of imposed-deep misalignments adequately – they were just '70% solutions'. For example, bill generation was at a 'crawling speed', in part due to the heavy package customisation. This led to many complaints by unhappy customers. Hospital A even had to put up signs to restrict customer 'abuse' of front-line officers. It also began discharging patients without billing and resorted to subsequent sending of bills to patients' homes. Similarly, the customisation of the patient accounting and management module to cater to bed-class subsidy affected the module's interface with the accounts receivable system. Billing information could not be updated immediately, making it difficult to respond promptly to customer inquiries of account balances. There were also a handful of imposed-deep misalignments that were not customised. For these, the efforts in organisational adaptation were substantial. For example, effort was needed to manually check the eligibility for bed-class subsidy for some medical procedures.

The high number and proportion of imposed-deep misalignments made Hospital A's rollout difficult despite the fact that it had a strong internal IS and a user project team that was significantly more experienced than the Hospital B team. The entire implementation by Hospital B, on the other hand, was relatively smooth. It was completed within 18 months, compared to the 30-month implementation in Hospital A. The enterprise e-procurement system implementation was also deployed without significant problems in DEF_CO. The 2-year project was hailed by management as a success in delivering the promised savings and convenience. Both Hospital B and DEF_CO had far fewer imposed-deep misalignments. These observations suggest that package implementations that have a high number of misalignments and a larger proportion of imposed-deep misalignments (which almost always result in customisation) are likely to be less successful.

The dynamics of imposed and voluntary structures

The empirical findings also revealed the dynamic boundary between imposed and voluntary structures. While the demarcation between imposed and voluntary structures was reasonably clear and stable for most of the misalignments, we found a few exceptions where there were interesting shifts between them during package implementations.

The overturning of an imposed structure was observed in DEF_CO. The procurement monitoring by sub-vote structure (allocated funds pre-approved for specific purposes) was a mandated practice from the Ministry of Finance. As the e-procurement package was developed in the context of commercial resource management, it did not have the functionality to track expenses at the comprehensive sub-vote level. Ontologically, this would require the tagging of expenses with an additional sub-vote property. DEF_CO did not customise this imposed-deep misalignment. Instead, the project team sought approvals up many levels of hierarchy (including a high-level cross-ministry committee) to do away with the sub-vote tracking requirement within DEF_CO. DEF_CO had to provide 'concept proof' that it was possible to streamline and merge the main and sub-vote structures into a single level. The approval only came after almost a year of consistent lobbying by the project director. There were also external factors at work. The avoidance of this imposed structure was successful in this instance because the Ministry of Finance was in the process of transforming itself towards a 'new financial paradigm' that would adopt more private sector resource-management practices.

The evolution of a voluntary structure towards an imposed structure was observed in the two hospitals. The package structures encouraged and supported activity-based costing (ABC). Neither hospital was using ABC prior to the package implementation. During the period that the package was being implemented in the two hospitals, however, the Ministry of Health began to consider and then to encourage the use of ABC in hospitals. While this was not yet a mandatory requirement during the implementation period, hospital management expected that it would be in the near future. They were therefore more open to adapting organisational structure and processes to the package where such changes seemed congruent with future implementation of ABC.

These exceptions revealed the dynamic nature of imposed structures. While such structures had taken a long time to evolve and were difficult to change, these organisations could still scan the external institutional reality and sense possible opportunities to pioneer the dismantling of old structure and the establishment of the new institutional reality. Package implementations were important catalysts in accelerating the process of institutional change.

Key ontological deficiencies in deep structure

The empirical findings also exposed dimensions of the deep structure that were more problematic in package software implementation. Figure 1 presents a more fine-grained view of deep structure misalignments. Across the three cases, a major ontological deficiency arose from the *transformation* sub-dimension – reflecting the package software's inability to capture the implementing organisation's unique business rules, policies, and procedures in operational processes. For example, in the hospital cases, such transformation misalignments included billing by payment class, payment class upgrades/downgrades (as patients moved from a higher bed class to a lower bed class or vice versa), non-resident pricing, the billing of higher of accouchement or caesarean fees, and split fee computations for revenue sharing among specialist consultants.

Equally problematic were ontological deficiencies in the *property* sub-dimension. Hospital A, in particular, experienced many such property-related misalignments because it was a pioneer in adopting the package in the local healthcare sector. Many properties required to describe things in the implementation context were missing. For example, bed class, National Service men status in the patient master file, a patient's Central Provident Fund account number, and additional newborn baby information (such as head circumference). These missing properties were particularly problematic when they were needed used as inputs for some computation (e.g., bed class was needed for billing and subsidy computation) or to establish relationships with another entity (which typically needed to be modelled as mutual property in ontology). An example of such misalignment was the need for ward sharing across medical specialties in bed management, which was not supported by the package because it did not model the M:M bed–patient relationship. Yet another was the difficulty of using an NRIC number (unique national identification number) to retrieve payment records in the financial module in the ES package.

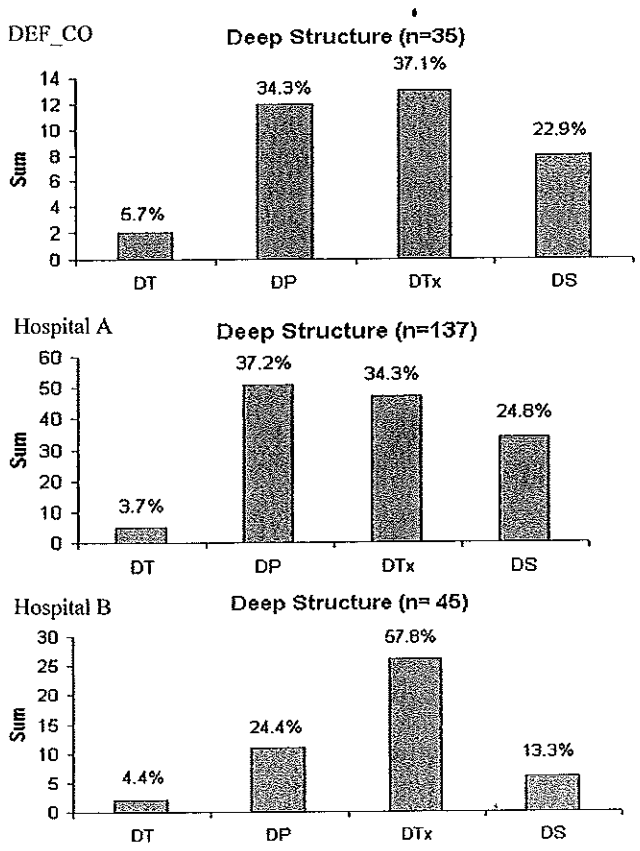


Figure 1 Deep-structure misalignments: ontological sub-dimensions.

Fewer misalignments arose from the *state* sub-dimension. These were mostly about the package's inability to capture the lawful state space. For example in DEF_CO, the package could not verify that various funds did not exceed established threshold values or that invoice quantity should not exceed PO quantity. In Hospital A, the package could not verify that the patient's Medisave account (a compulsory medical savings account to which all employees contribute) details were correct.

The lowest number of misalignments arose from the *thing* sub-dimension. Most real-world entities and events appeared to have been captured by the packages; however, in some situations they were not adequately represented. For example, while the ES package in the Hospital A provided for the inclusion of counter-payment in the local context, it could only do so by treating counter-payment as a property of payment. This ontological representation, however, was insufficient. The large volume of counter-payment as well as the need to relate counter-payments to instalment payment plans, and government subsidy amounts required that counter-payment be represented as an entity in its own right.

These findings highlight ontological dimensions that are likely to be more problematic in package software implementations. Missing things are rare, suggesting that the basic things in business processes are relatively stable across diverse contexts. Key challenges seem to be in modelling the conceivable and lawful space for transformation, properties (especially relationships), and states of things. These empirical observations affirm empirically what has been proposed in prior ontology research. Green & Rosemann (2000), for example, noted that many modelling grammars (including ARIS, a popular enterprise modelling approach deployed in SAP implementations) do not have sufficient representations for conceivable and lawful transformation/state space. Similarly, researchers such as Weber (1996) and Wand *et al.* (1999) have highlighted the modelling ambiguity for the relationship construct.

Conclusions and implications

The framework and findings show that the embedded 'best practices' in ESs are predicated on specific institutional and ontological assumptions. Misalignments arise

when the embedded institutional and ontological structures differ from those structures in the implementation context. The empirical findings affirm the feasibility of applying the severity assessment framework in understanding package–organisation misalignments.

Misalignments that are related to mandated external requirements (imposed structure) and key elements of reality (deep structure) are likely to be severe. On the other hand, misalignments that are within organisational discretion (voluntary structure) and related to superficial or cosmetic elements of reality (surface structure) are likely to be less severe. Assessing misalignments from the institutional and ontological perspectives thus provides a good indication of the extent of severity and the related organisational response as reflected in the varying proportion of customisation across the types of misalignments in our findings.

As the production and consumption of package software are uncoupled and the links are not direct (Keil & Carmel, 1995), our framework and findings also suggest that implementing organisations and package developers may have different strategies for addressing each type of misalignment.

Achieving alignment: the consumption perspective

From a consumption perspective, package–organisation alignments are achieved by individual organisations through careful selection of package software, proper configuration and customisation, working around the system, and eventually through upgrades or replacements by a better package. It is important that organisations identify the significant misalignments early to make sound decisions on whether to adopt the package and, if so, to assess the extent of customisation and organisational change required such that adequate resources can be provided and proper change management be put in place. Organisations can structure the evaluation of packages by probing the discrepancies between the structures embedded in the system and the implementation context. Specifically, what are the key *entities*, the *properties* of key entities, the *transformation* rules, and their lawful *states* that are unique to firms operating in this *country*, this *industry*, or in this *strategic organisational context*? Clearer analysis would be enabled if implementing organisations continuously worked to improve the transparency of their business rules concerning their key data and processes.

For imposed structure misalignments (ontologically deep or surface), implementing organisations may want to consider a delayed adoption strategy to allow sufficient time for package vendors to localise the package. As these misalignments relate to country- or industry-wide regulations and norms, vendors who wish to increase the adoption of their packages in a country and/or industry will be motivated to incorporate the imposed structures over time. Pioneering an enterprise-wide package implementation in a new industry or new country is likely to be risky. Alternatively, such organisations can attempt to rally other organisations facing similar dilemmas in package software adoption to lobby the vendor for localisation. In rare instances, organisations may also be able to 'overturn' existing imposed structures as these structures weaken or loosen in the midst of new institutional dynamism. Imposed structures are not absolutely immalleable.

For voluntary-surface misalignments, tight control over such change requests is likely to be an effective response. Unless these misalignments are related to some strategic imperatives or emerging imposed structures, they should not be customised. A key ingredient in this process is to institute sufficient senior management authority in the project team to defray unreasonable demands from powerful staff or line managers. Organisations should put in place early and sustain change management to manage user expectations and to provide adequate training to facilitate adaptation to the package.

The resolution of voluntary-deep misalignments in package systems is likely to be problematic. Such systems are often limited in catering to the range of voluntary responses individual organisations acquire to cope with their external environments. Lobbying the vendor is less likely to work as the requirements are organisation specific. There are few mass-market forces that would lead vendors to localise or to incorporate organisation-specific requirements in future upgrades. Organisations often have to bear the cost themselves by engaging the expertise of local systems integration consultants or specialised vendors for further customisation and to deal with the subsequent maintenance issues. Hence choosing to be unique will become an increasingly costly option. Organisations should be mindful of the 'differentiation trap'. They should critically evaluate their internal organisational complexity and identify those aspects that really need to be different, competitively or strategically. Continuous streamlining to reduce organisational complexity is one way to reduce the number of such voluntary-deep misalignments.

Achieving alignment: the production perspective

The implications for misalignment management can also be seen from the production perspective. As the negotiations between producers and consumers are often conducted at the market level (Sawyer, 2001), package–organisation alignments are achieved by vendors through the modularisation of package functionality, the offer of industry-specific solutions, package localisation, and, more recently, the shift to a service-oriented architecture that allows bolt-on solutions. The emphasis is always on the mass market.

Our framework and findings suggest that package vendors, in advocating embedded package structures and processes as 'best practices', should be mindful of the risks of going against institutional forces in a new country/industry, particularly when deep ontological structures are compromised. The framework provides some guidance to vendors in the prioritisation of

functionality for future upgrades. Clearly, addressing imposed (both deep and surface) requirements, particularly for sizable market segments, will contribute to wider adoption of the package, since these imposed structures affect all potential implementers in the country and industry. The large number of voluntary-surface misalignments that are present in any implementation also suggests that vendors may want to develop flexible reporting and input capabilities to their packages or spend significant resources on identifying industry best practices in information presentation and building these into the package. Package vendors will usually find that incorporating voluntary-deep misalignments into the standard package provides a relatively lower pay-off, since such misalignments are organisation specific.

Package developers also need to pay more attention during requirements analysis and design to the specification of business rules that govern the structure (property, state) and behaviour (transformation) of the real world. More needs to be done to address the deficiencies in current approaches to capturing and modelling business rules. This is particularly critical as the scale of package software continues to expand and more 'best practice' processes (and their business rules, policies, and procedures) are built into the software. Such large 'process-heavy' packages such as ES demand careful attention to the modelling of business rules. It is no longer feasible for package vendors to adopt a passive development approach where business rules are assumed to be applied outside a package software and the role of the information system is to record the effects (i.e., state tracking) only.

Finally, these observations shed light on the tension between package–organisation alignment, that is, how packages and organisations affect each other's design and function. For 'less severe' misalignments (i.e., deep-voluntary, surface-imposed, surface-voluntary), the higher organisational adaptation implies that over time we would expect organisations to increasingly embrace such market practices embedded in the IT systems. For example, surface structure interfaces (e.g., screen design, report format) will become more standardised and will be determined externally by industry practices. Only for deep-imposed misalignments is it likely that the IT systems would be realigned to suit the organisations (e.g., through customisation or package localisation).

Further research

The research may be usefully extended in a number of ways. First, the approach to identifying package–organisation misalignments for research may be broadened to provide a more balanced view. In this study, we identified misalignments by using the RFCs. This may, however, have introduced a bias towards more severe misalignments. Future research may also attempt to identify additional misalignments through other project documents such as minutes of meetings, where misalignments may be discussed.

Second, the empirical analysis may also be extended in at least two ways to shed further insight on the early identification of misalignments: (1) The number and types of misalignments that arise in different phases of implementation. For example, some elements in the deep ontological structure may be more obscure and only surface later during implementation. (2) The number and types of misalignments may also differ across different functional modules. For example, accounting modules, which are subject to a greater degree of external standards such as internationally accepted accounting standards, may have fewer imposed-deep misalignments than customer-facing operations modules.

Third, future research may want to adopt a more refined categorical scale in coding the ontological structure. For example, the current classification of deep and surface structure misalignments treats missing 'thing' and missing 'property' as equal, even though a higher severity weight could possibly be assigned to 'thing', given its greater ontological significance. Emerging research (e.g., Rosemann *et al.*, 2004) in developing the notion of ontological distance is certainly a promising step in that direction.

Fourth, the way the misalignments are resolved may be more finely categorised. In this study, we collected data only at the broad level of package customisation and organisational adaptation. Finer differentiation (e.g., customisation could be broken down into core system customisation or customisation through user exits) may present more insights into the effectiveness of various approaches to resolving misalignments.

Finally, the relationship between project performance and misalignments (number, type, proportion customised) can be more systematically examined with a larger number of implementations and using the concepts and operationalisations introduced in this study. A systematic collection of performance data, covering both project performance (schedule and costs) as well as the impact of the package on organisational performance, will be needed. Quantifying the impact of individual misalignments, however, will remain challenging. In particular, the impact of organisational adaptation in terms of organisational effort, customer satisfaction, and possible loss of differentiation will be difficult to quantify.

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