Modelling intangibles using EM: a duo-hierarchy method in strategic resource analysis

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Abstract
In the global competition, the tangible resources as differentiating factors of competitive advantage losing their power. Whiles the subject of the intangibles and the knowledge management is associated with the high economic performance, and is becoming increasingly significant in the strategy implementation. This paper explores how Enterprise Modelling (EM) can be used to mitigate the gap between the theoretical stands of the importance of the intangibles and their practical application. In particular, the study presents the application of fractal enterprise modelling (FEM) technique in the strategic resource analysis. The aim of the research is to propose a duo-hierarchy modelling method for intangibles, and to apply it in a real case example. The business situation concerns the structural change within the product development processes in pursuit of the strategic leadership. The study deploys the Design Research (DR) methodology and generate a new knowledge about EM application in the intangible resource management. A clear and well-documented Word document is presented as an article formatted for publication by CEUR-WS in a conference proceedings. This article presents and explains many of the common variations, as well as many of the formatting elements an author may use in the preparation of the documentation of their work.

Keywords
enterprise modelling, intangible resource modelling, operant resources, resource management, fractal enterprise modelling, FEM

1. Introduction

The ability to create and utilise the difficult-to-imitate resources is one of the key success factors to differentiate and sustain a competitive advantage [1], [2], [3], [4]. In the global competition, the importance of the physical or tangible resources as the differentiating factors of the competitiveness is decreasing in relation to the soft or intangible production assets, e.g., those related to knowledge, competencies, technology, research and development [5]. Intangibles allow to utilise resources more efficiently through an accumulation of knowledge and information via learning and innovation [6]. However, there is relatively poor research about how enterprise modelling (EM) can be used to mitigate the gap between the theoretical stands of the importance of the intangibles and their practical application. Besides, few existing studies focus on the separate intangible categories, e.g., capabilities [7], R&D and learning [8], human and social capital [9], or human, social and technological capital [10]. Whiles, [8] note that the single asset contains the whole bundle of the intangibles, and the integrative approach is needed.

In general, the resources are often described in terms of the operand (typically physical) and the operant (skills, knowledge, organisational culture, relationships, etc.) [11], [12], [13]. One way to organise the resource analysis is to deploy the notion of resource hierarchy. Some researchers argue that the resources should be arranged in a hierarchical fashion [11], [14], [15],

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[16]. For example, it has been suggested that the competences and/or the capabilities belong to higher order resources; because of they represent a collection of routines and assets, that together with other inputs, produce a significant outputs of a particular type [15], [17].

Therewith, the strategic view on the resource analysis suggests to enrich the notion of intangible resource hierarchy not only with the level of their development but also with the complexity in their composition. One example of such hierarchy can be found in [16]. The authors introduce the model of the operant resource hierarchy based on the intangible resources' composition and the interaction between them, i.e., basic operant resources (BORs), composite operant resources (CORs) and interconnected operant resources (IORs). However, as noted by [16], the classification and categorisation of the operant resources in the literature suffers from the lack of the conceptual distinctiveness between CORs and IORs. This problem makes the analysis of the operant resources in the particular organisational settings more challenging. In fact, the currently suggested hierarchy of the resources is criticised for being elusive because of there is no explicit or tangible patterning of the activities governing such resources and their adjustments [15]. Besides, such conceptual models are too generic and offer little practicality due to high level of abstraction [18], [19], [20].

EM may be helpful for visualization of the intangible resource hierarchy and their composition in a particular business instance. However, at the present moment of this paper, there have been no such attempts identified in the research field. The main body of research on intangibles is dedicated to intangible resource evaluation using mathematical and/or statistical models, such as in [21], [22], [23], [24], [25].

Thus, the practical problem addressed in this study, is a lack of the EM techniques for analysis of the intangible resource building considering double hierarchy. Previously, EM has been used for modelling a generic resource development hierarchy, i.e., from assets to capabilities development, see example in [26]. In this study, the approach accounts for the operant resource hierarchy, i.e., how the BORs are organised to comprise CORs and/or IORs in a particular business situation.

Therewith, the objective of this paper is to propose a duo-hierarchy modelling method using EM, in particular Fractal Enterprise Modelling (FEM). In particular, the proposed method combines two types of the resource hierarchies: a) the general resources development hierarchy [27] (used previously in [26], [28]), and b) the operant resource hierarchy [16]. This study also aims at applying the new method in a real business situation. Thus, the research belongs to design science research (DSR) methodology.

The paper is structured as following: Section 2 presents the short re-cap of the business case and the research background; Section 3 describes the methodology used; Section 4 gives more details on how the deign to modelling intangibles has been approached; Section 5 introduces FEM; Section 6 presents the results of practical application of the proposed method, where implications from the case example are also discussed; Section 7 lists the lessons learned and outlines the limitations and future research; and in Section 8 the concluding remarks are given.

2. Research background and business case

Previously, the method of modelling of generic resource hierarchy has been applied in a real-world example of the R&D analysis, where two patterns related to building organisational competence have been identified [26]. These patterns represent the adaptive learning and the generative learning. The organisational structure has been pointed out as one of the main facets in distinguishing the patterns; because of the structural aspect 'shapes the behaviour of the members' [13]. One of the prominent aspects related to usage of the structure in resource development, has been the change in coordinating asset controlling the R&D processes. The case example illustrated how the change in structure may enhance the organisational learning capability through better acquisition of the intangible resources. It has been shown that the new

structure has affected the intangible coordinating mechanism through the tangible assets shaping the coordination, such as instructions for product development: from the product requirements at the operational level to the long-term product strategy at the strategic level (see Figure 1). The upper graph in Figure 1 illustrates the re-active approach, where the company is being directed by the 'Customer product requirements' at the operational level. In this situation, the R&D team's coordination exhibits the behavioural norms based on the assumption that the customers know exactly what they want. Such assumption normalises the expected employees' behaviour of listening to the customers and match their expectations, i.e., delivering a best quality solution rather than keeping up with the rapid industrial change and strategic innovation. For example, it is unusual for R&D engineers to provide any feedback to the customer prior the profound quality checks. This practice has been historically successful; therefore, there is lots of confusion among members about why the profitability is declining. The lower graph in Figure 1 illustrates the pro-active approach, where the company develops a 'Long-term holistic product strategy' together with the customer (see more in [26], [28]).

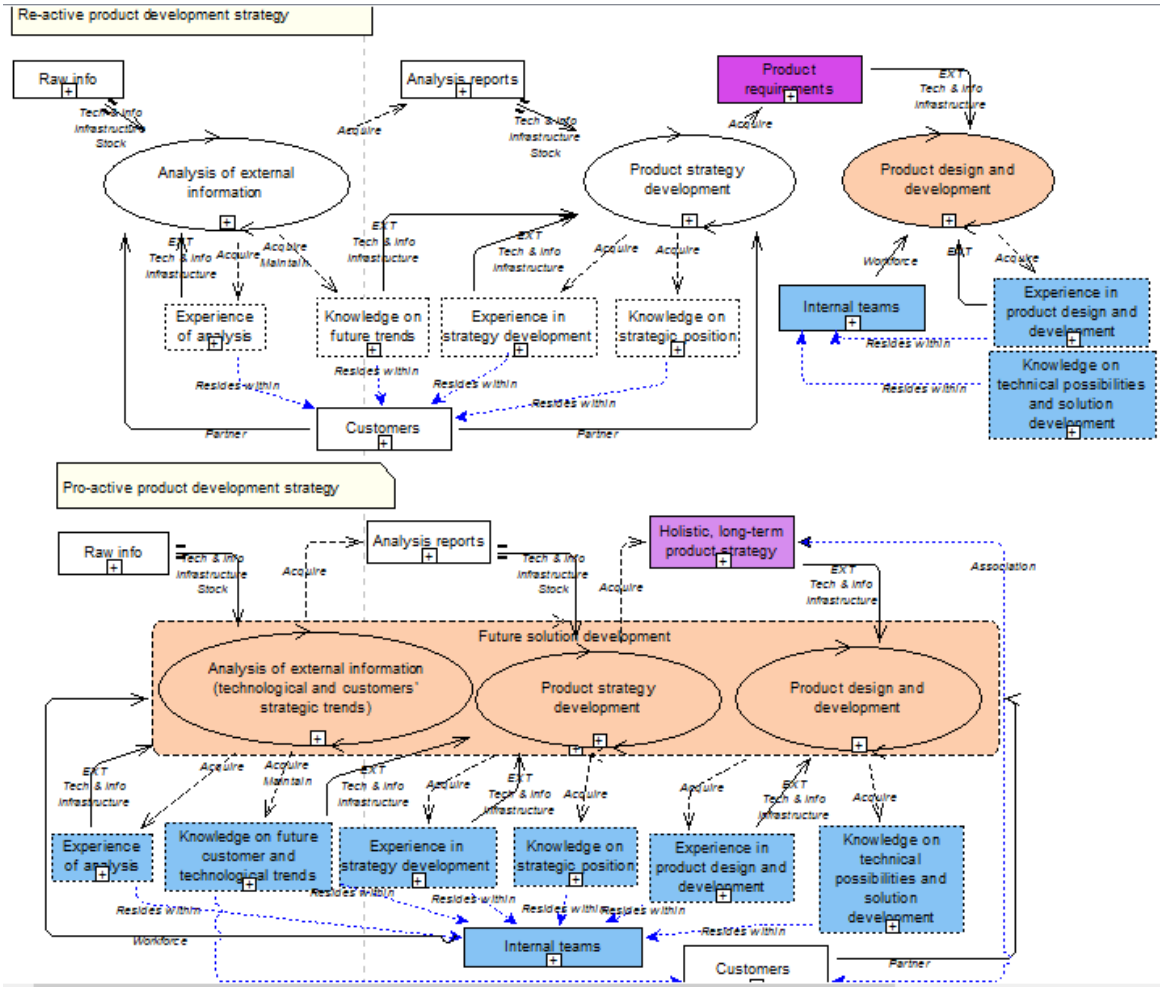


Figure 1: Case example models of re-active and pro-active ways of working in product development (borrowed from [26]). Shapes: ovals – processes, rectangles – assets/resources, arrows – different types of relationships (see more in Section 6 'Modelling intangibles using FEM'). Colours: in pink are shown the organisational processes, in blue – organisational assets, in purple – coordinating assets, in black and white – the elements outside the organisation).

To achieve the overarching coordination, the activities of a new department focus on early engagement with the external environment by 'actively hunting for the information'. Namely, by reaching out to the strategic customers before 'they know' what they want, by obtaining the technological information on the future products together with the customer, and by feeding this information back at the high organisational level to ensure a strategic coordination. However, there are many intangibles behind each tangible resource and to acquire such resources is a complex matter based on the development of the unique series of the organisational activities [4]. Therefore, to improve the resource management and sustain the pro-active way of working, further investigation of the underlying intangibles is needed. More on the case description can be found in [26], [28].

3. Methodology

The aim of this study is to propose a duo-hierarchy method for the intangible resource analysis by combining the operant resource hierarchy model and the resource development hierarchy using EM, in particular FEM. Thus, the presented research belongs to design science research (DSR) methodology. The process of the DSR consists of several iterative steps, such as: 1) identify the problem, 2) define the solution, 3) design, 4) demonstrate, 5) evaluate, 6) communicate/report [29]. This paper reports on the results of the EM design solution (a duo-hierarchy method for modelling intangibles using patterning) as well as demonstration/evaluation by the practical application of the proposed design.

The knowledge obtained in the preceding studies, where FEM has been applied in the strategic analyses, is used as an input to the design solution, more detail in [28], [30]. According to [29], the demonstration requires effective knowledge on how to use the tested artefact to solve a specific problem. Thus, the demonstration step in this research aims at showing how the proposed method can be used in the strategic operant resource analysis. The outcome of this step takes a form of the FEM models illustrating the relevant to the analysis resources and processes of the enterprise. The models produced for the case have been analysed from the perspective of the duo-hierarchy patterns; where the business situation in intangible resource management have been diagnosed.

The demonstration and the evaluation steps, usually, are inseparable but the evaluation requires certain assumptions about the solution's performance [29]. From the modelling perspective, the proposed solution should be able to support the quests to represent different type of operant resources and their composition. From the DSR perspective, the knowledge obtained during practical application of the new method, can be fed back into the design phase. Form the practical perspective, the application of the new method should provide the useful insights about the business situation, i.e., the state of the strategic resource management. Hence, any outcome, positive and negative, generates a new knowledge that can be used in developing a better solution for a given problem. It advances the general knowledge about EM usage for the purpose, it also provides more insights about how particularly FEM can be used in the intangible resource analysis, and it helps to generate new ideas about the future research directions.

The paper, also, presents the example of the method application using a real business case. The practical question to answer is how someone using EM, can understand the intangible resource composition and modify them through the change in tangible resources e.g., organisational structure. The question can be answered in two ways. The first way is top-down, i.e., to identify the key IORs necessary for reaching the strategic objectives, and then, decompose them into CORs and/or BORs. The second way is bottom-up, i.e., to map the key basic tangible and intangible resources (BORs) in the given process/s, and analyse their usage in order to discover the combinations that may comprise CORs and IORs. The latter approach to resource analysis has been performed in the presented business example.

Note, that to illustrate the logic of such analytical process, a very simple and generic example of operant resources' constructs has been used, i.e., one key organisational competence within R&D has been presented at a simplistic level. Besides, the process of explication of the relevant information in the case study is inherently subjective and the matter of biases [31]. Furthermore, considering the arguments that the perceived usefulness of modelling is in the modelling process, and not in the models themselves [32], a single participation of a junior researcher in the case analysis enhances such biases.

4. Approach to modelling intangibles

There are three intangible resource frameworks combined in this work to design a modelling technique technique using FEM notations. The deployment of these frameworks contributes to the more holistic approach to the intangible resource analysis in following ways:

- the classification of the intangible resources [12] is used to map the different types of the intangibles, e.g., knowledge related, relational, cultural, etc.
- the generic resource hierarchy or the value innovation resource hierarchy [27] is used to outline the position of a certain resource within the organizational structure, i.e., a scope perspective,
- the operant resource hierarchy [16] is used to denote the composition of a certain resource, i.e., the complexity perspective.

4.1. Classification of intangibles

There are multiple ways to classify the intangible resources, see for example [13], [33], [34], [35], [36]. In this work, the intangibles categorisation proposed by [12] is adopted. They describe the tangible and intangible resources in terms of the operand and operant. The operand resources are typically physical (raw material). The operant resources are typically human (skills and knowledge of individual employee), organizational (competences, routines, control mechanisms, cultural norms and values), informational (knowledge about market, technologies and competitors), and relational (with customer, competitors, suppliers). Unlike the informational resources, the knowledge related resources may take form of explicit (visible and documented) and tacit (invisible that resides within an individual) [37]. Furthermore, [38] describes a tacit knowledge in terms of the two comprising elements: cognitive & technical. The cognitive elements represent the individual's mental maps, beliefs, values, paradigms, viewpoints, etc., i.e., the culture-related intangible resources that may indirectly control the process execution [39]. The technical component represents the knowledge applied to a particular context such as skills, craft, know-how, etc., i.e., the knowledge-related intangible resources that may directly control the process execution [40].

Since both, human and informational, operant resources in [12] classification represent some type of knowledge, i.e., a technical tacit knowledge (e.g., skills, crafts, know-how, etc.) and/or an explicit type of knowledge (e.g., explicated from human heads and documented), they can be grouped into the same category, the knowledge resources. While, within the organisational category of operant resources, the elements such as cultural norms, values, beliefs, attitudes, etc., represent the cognitive type of knowledge in definition of [38]. Therefore, can be grouped as a cultural resource. Therewith, in this work the intangible resources or operant resources, in terminology of [12], categorisation has been adjusted forming following three categories: knowledge related, cultural and relational resources.

4.2. Generic resource hierarchy

In this work, the value innovation resource hierarchy [27] is used to refer an intangible resource to the organisational scope. Whereas, the concept of the operant resource hierarchy is used to denote the intangible resource complexity [16]. The resource complexity perspective provides more details about the intangibles' construction at a different organisational scope (i.e., at the resource, competence and capability levels). Hence, the fusion of the two perspectives enhances the analysis of the intangible resources.

The classification of the intangibles applied in this work (i.e., knowledge, cultural and relational), is systematised following the analytical logic proposed by [27] and adapted in [28]. Namely, such resources are arranged according to the context of their application and development within the organisational scope:

- Asset level – the physical resources, such as workforce, representing a repository for the intangible resources.
- Resource level – the personal skills, know-how, competences, etc. to perform a task in an effective and efficient way to contribute in the production of valued market offer (strategic).
- Competence level – the combination, coordination and management of the personal knowledge, skills and competences of the teams, the unit or function level to produce effectively and efficiently valued market offer.
- Capability level – the coordination of knowledge, skills, etc., within and between the multiple organisational functions and units (the organisational level) to produce effectively and efficiently valued market offers.

Note, that assets are not considered in this research since they do not represent strategic intangible resources according to presented approach to classification.

4.3. Operant resource hierarchy

The value innovation resource hierarchy [27]) has been complemented with the operant resource hierarchy proposed by [16], which adds the complexity dimension to the intangible resource analysis:

- Basic operant resources (BORs). The basic operant resources might be viewed as the underlying, low-level resources that form the higher-order operant resources, e.g., skills and knowledge of individual employees. Note, that these resources only become the entities of such categorisation only if it contributes to production of offering that has value for some market segment according to the authors. Hence, BORs describe distinct or firm-specific operant resources. The typical BORs represent human related, organisational, informational and relational resources.
- Composite operant resources (CORs). The composite operant resources are the combination of the two or more of distinct BORs with a low-level interactivity. At this level, they collectively enable the organisation to produce effectively and efficiently valued market offerings. For example, basic resource A+ resource B + resource C = composite operant resource D. Note, that according to [16], the lower order resources that are combined to become COR can be both, the tangible and the intangible. However, the presented study is concerned only with the modelling of intangibles. The examples of CORs identified by [16] among others:
- Interconnected operant resources (IORs). The interconnected operant resources are similar to CORs but with the significant amount of the interactivity among its constituents. Thereby, they reinforce each other in producing effectively and efficiently the valued market offerings. IORs may consist of both, the basic (BORs) and the higher order resources (CORs). The reinforcement can be identified by the resource influence

on each other as resources AxB, BxC, AxC and/or AxBxC (A, B, C are resources). The examples of IORs identified by [16] among others:

Authors note that as the firm goes up in the hierarchy, the competitive advantage from the resource become more sustainable because of the resource become more inimitable and none-substitutable.

In this work when approaching modelling and patterning intangibles, the concept of generic value innovation resource hierarchy is used to refer to an intangible resource to show its level of development, i.e., referencing to the organisational scope. Whereas, the concept of the operant resource hierarchy is used to refer to an intangible resource complexity at any level of development, i.e., at any organisational scope. Figure 2 illustrates this logic.

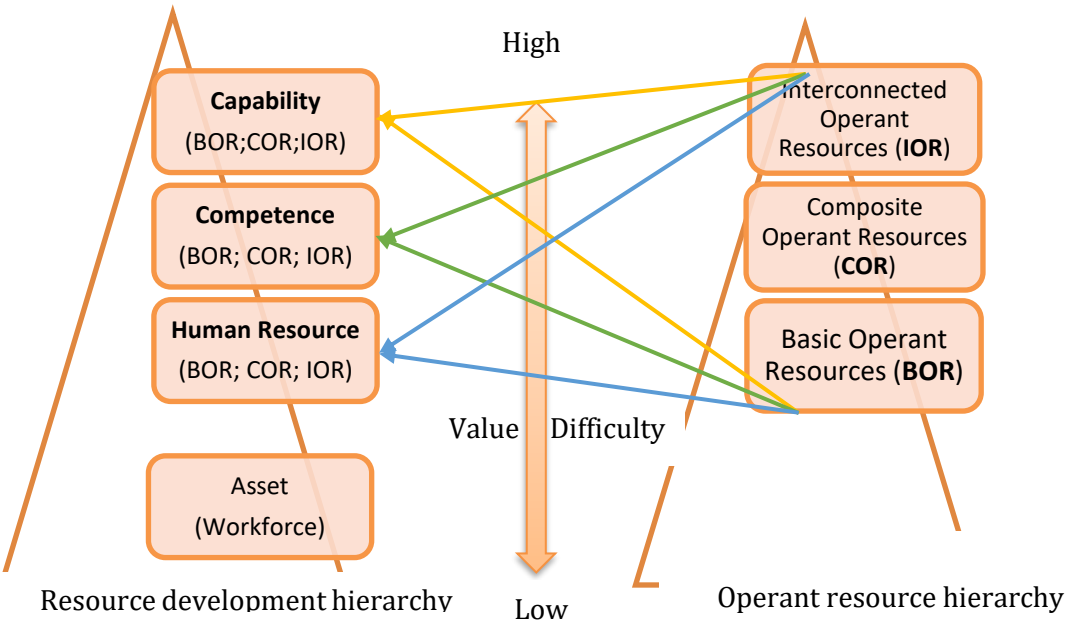


Figure 2: Combination of intangible resources' hierarchies (adapted from [16], [27]).

5. Modelling intangibles using FEM

FEM is a modelling technique based on the fractal view on an organisation [41], [42]. Graphically, it represents the system of interconnected processes and assets; whereas, a process has an oval shape, an asset is rectangular, and the relationships are captured by the arrows of different types, see example in Figure 3. Together, these elements construct different types of patterns: a process-asset pattern shows the assets used in the process (see (a) in Figure 3), an asset-process pattern shows what processes must be in place to manage a given asset (see (b) in Figure1), and a decomposition of a process which provides more details about the activities and assets in a given process (see (c) in Figure 3).These patterns represent the fractals which can be alternated to create a directed graph relevant to a particular situation showing the chain of the relationships across the fractal levels. The ADOxx toolkit is used to implement FEM software tool [15]. More about modelling with FEM can be found in [16], [17] or dedicated website www.fractalmodel.org.

Although, other techniques may also be suitable for the purpose, FEM has been chosen because of it covers the necessary requirements for the presented study, such as the possibility to visualise the low-level intangible elements on the basis of which the higher-level intangibles can be developed, i.e., competences and capabilities. Besides, FEM advances other EMs by its recurring structure allowing to navigate the relevant chain of the relationships across the fractalic hierarchy of the processes and assets paying attention to their roles in the system.

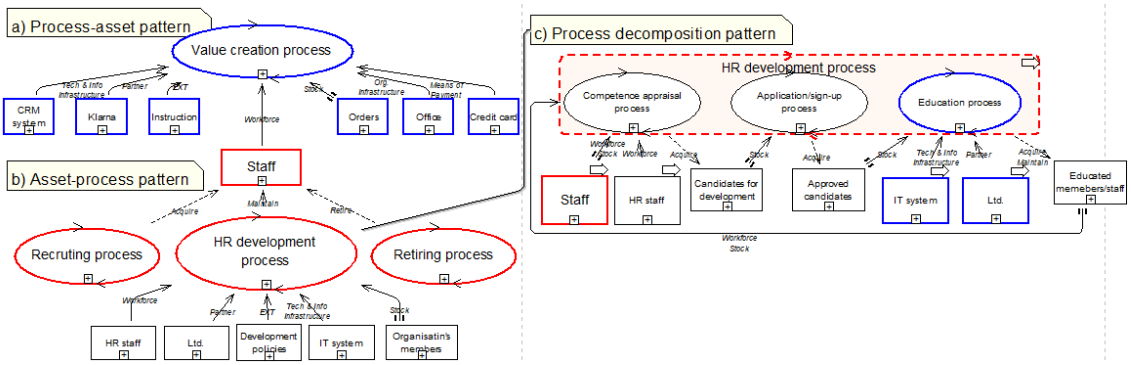


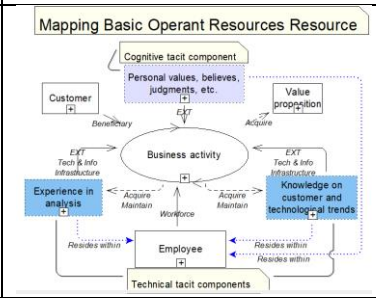
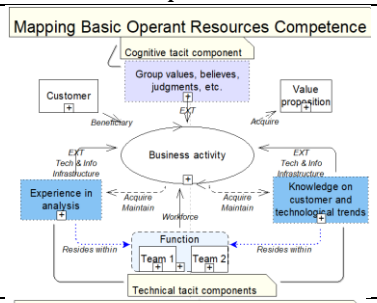
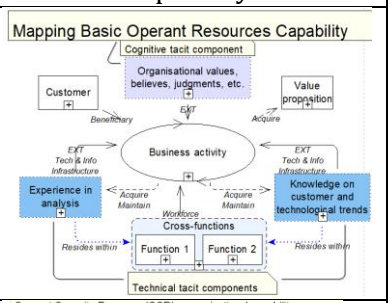
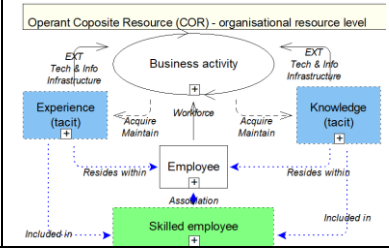
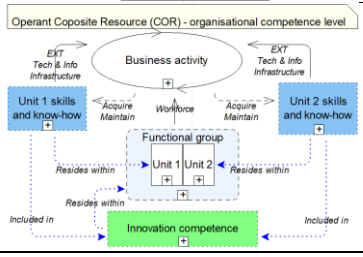
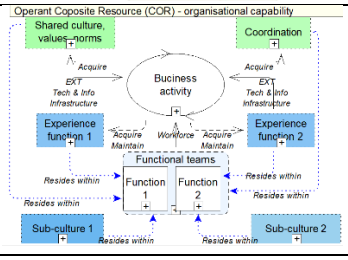
Figure 3: FEM generic patterns.

The patterns for modelling a generic value innovation resource hierarchy using FEM has been described in [28]. In particular, through connection of the knowledge and experience type of assets to the 'Workforce' asset at different hierarchical level, it was possible to notate the owner of the intangibles within the organisational system. For example, if the knowledge is possessed by a person, then such resource is 'resides within' the lowest level of the organisation. Hence, this knowledge is accessible only to a particular employee and might be lost by an organisation when he/she leaves. In contrast, if such resource 'resides within' a 'Workforce' asset representing the team or inter-functional teams, then the resource is commonly shared and accessible among multiple people, or functions respectively; thus is an organisational resource.

In this work, the intangible resource development patterns have been developed using FEM by combining the generic value innovation hierarchy is combined with the operant resource hierarchy. The examples of duo-hierarchy patterns are summarised in Table 1. To denote different types of operant resources, such as BORs, CORs, and IORs, the intangible assets (in dashed boarders) are used. These assets play the role of inputs in a business activity, which is denoted with 'EXT/Tech&Info Infrastructure' connection. To show the level of resource development, the links 'reside within' indicate which type of 'Workforce' asset possesses a given resource: an employee, a team or a function respectively.

Table 1.

Meta-table of hierarchies with examples of fem modelling patterns. Legend: in blue – BORs, in green – CORs, in yellow – IORs

	Resource	Competence	Capability
BOR			
COR			

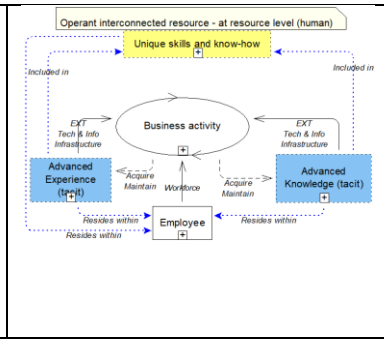
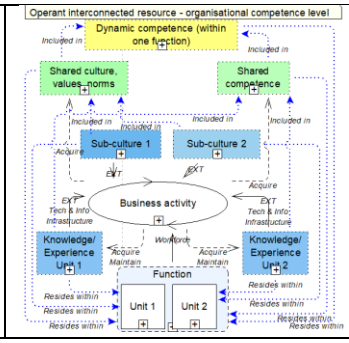
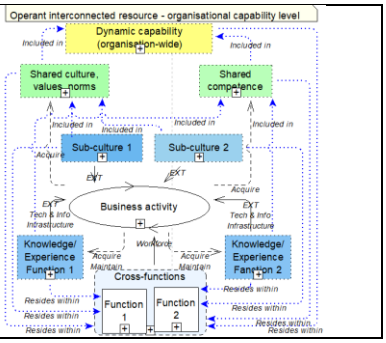
IOR			

Table 1 shows:

BOR/

- Resource level: at resource level, an employee's tacit knowledge, including technical and cognitive, e.g., experience and subject knowledge, and personal values and beliefs, represent the lowest level components of organisation's intangible resources.
- Competence level: at organizational competence level, the experience and knowledge obtained in a business activity is shared within the entire team. Hence, organisational cognitive tacit knowledge is transparent, which may lay the grounds for higher-level resource development.
- Capability level: at the highest basic resource development level, an organisational capability is obtained when cross-functional teams' tacit knowledge is shared and accessible to all members of an organisation. Note, at this stage the composition or interconnection is not yet considered, only the possession of such.

COR/

- Resource level: a basic example of COR at the resource level is a combination of BOR resources at individual level, such as personal experience and knowledge, etc., of an employee that produces a COR 'skilled employee'. This type of COR represents a valuable human resource that provides an organization with unique skills and know-how to make a process more efficient.
- Competence level: an example at the organisational competence level, is the combination of 'know-how's (based on tacit knowledge of different teams) from multiple units that together build the base for an innovation competence at a functional level.
- Capability level: an organizational capability might be built upon intra-functional coordination which includes a composition of the tacit knowledge (technical and cognitive) of employees from different functions. Another example, is shared cultural values and beliefs that allow a business activity to run smoother.

IOR/

- Resource level: an example of BORs at individual level is the knowledge and experience that are acquired and reused in a business activity, i.e., the acquired knowledge in a task, changes the way the task is performed and vice versa. These individual assets reinforce each other to acquire a unique ability to perform a task in such a way that may produce different type of the process's outcome, e.g., making it more effective.
- Competence level: an example of IOR at the competence level might be a dynamic coordination. Such a competence is based on the shared competences between teams, the resource that is reinforced by the common cultural norms, views, beliefs, etc., possessed by employees within one function. Such reinforcement may change the

processes' outcome by better understanding, reaction and nature of the response to the new information at a functional level.

- Capability level: at the capability level, the organization-wide dynamic coordination become a higher-order operant resource (capability). It emerges on the basis of the common cultural values, norms of behaviours, etc., shared between different functions (note, the sub-cultural difference still may exist). The common cultural norms ease the knowledge exchange between different functions, i.e., reinforce the competence share and the knowledge application throughout the organization. Thus, improve the adjustments and responses to the new information, which may also change the process's outcome.

6. Method application in resource analysis

Figure 4 represents the extended version of the process 'Product strategy development' presented in Figure 1. Particularly, it provides more details on usage of the intangibles in its sub-processes, such as, 'Processing customer requests' and 'Providing feedback on request'. For instance, the former sub-process uses the BOR knowledge 'Technical expertise tacit knowledge' which is resided within the internal R&D team. Also, the BOR tacit knowledge, such as, 'Experience in processing customer requests', is acquired and reused in this sub-process (blue rectangles in Figure 4). Hence, these two BORs (among others) composite the COR related to knowledge type of intangibles. The R&D unit members disseminate and/or absorb the new knowledge during the sub-process 'Developing a solution', where the customer request's analyses are discussed. The experience of creating a product design together with other members, leads to learning how to collaborate. Hence, in this sub-process the two BORs relational resources are acquired and reused, which enhances the competence of collaboration within R&D function, i.e., form the relational COR resource 'Functional coordination'. Note, that the cultural BORs control the member' behaviour organisation-wide, i.e., is applicable in all processes, including the entire 'Product strategy development'. Thus, this BOR is a constituent part of all higher operant resources: directly, e.g., the COR relational and IOR; or indirectly, e.g., influencing the IOR through the COR knowledge. Hence, Figure 4 shows that the organisation's IOR 'Organisational competence in product innovation' consists of the combination of at least two CORs ('Technical competence' and 'Functional coordination') and a BOR 'Internal cognitive tacit knowledge'. The reinforcement occurs through influence of the internal cognitive tacit knowledge (the culture) on the way engineers collaborate; which in turn, has an effect on the organisational technological competence building.

Although, it is argued that the possession of such IOR sustains the competitive advantage [16], a deeper case analysis suggests that this may not always reflect the truth. For instance, Figure 5 maps the difference in the combinations of BORs, CORs and IORs used in the 'Product strategy development' process before and after the structural change. In Figure 5, the black-bordered assets (dashed and solid) capture the combination before the structural change; while, the red-bordered elements (dashed and solid) capture the additional processes and assets introduced after the structural change. The difference is associated with the level of IORs development within resource hierarchy described in [26] (see Section 3 'Approach to modelling intangibles'). In particular, it has been detected that the level of the IOR development in product innovation ('Organisational competence in product innovation') belongs to the competence rung within the general resource development hierarchy, i.e., lies within the scope of one function, such as R&D unit (denoted as 'Workforce' in the process). After the change, the organisation appropriated the IOR at the capability rung, i.e., the ultimate level in the resource hierarchy. Namely, the IOR 'Organisational Entrepreneurial proclivity capability' (Figure 5) has been developed on the basis of differentiated BORs and CORs. The acquisition of such differentiated intangible resources has

been enabled through the establishment of the new team ('Tech advisory global team') and the sub-processes it performs, 'Hunting for industry technical knowledge' and 'Strategic customer identification and suggesting their future requirements'. There are two peculiarities with such a move. First, the new team place a role of interconnector between the executive and operation levels, i.e., it works closely with R&D function but, also, is directly involve into long-term strategy development function. Second, the new processes it executes, require entrepreneurial cultural norms and behaviour, i.e., different form existing, which are safety-oriented.

The sub-process 'Hunting for industry technical knowledge' introduces the acquisition of the broader and deeper technological knowledge, e.g., BOR 'Industry technical tacit knowledge'. It also introduces the entrepreneurial cultural norms and behaviour which are necessary to execute such tasks, i.e., BOR 'Cognitive tacit (Innovative, risk taking, proactive behaviour norms and values)'. All these BORs, including the experience in this new process, reside within the new team 'Tech advisory global team'. Together, they construct the COR 'Pro-active product innovation competence' and are included in new IOR 'Organisational entrepreneurial proclivity capability'. Hence, by establishing a new team and processes, the organisation bonds together different functions through introduction of new cultural norms and behaviours. Note, that these new norms and behaviours are resided only within one part of the organisation at the start. How this partial strategic-operational coordination enables adjustments in all other parts of the organisation and its functions, is the matter of a more complex schemata in knowledge resource management and organisational learning, which is a future research agenda.

The sub-process 'Strategic customer identification and suggesting their future requirements' enables the acquisition of the BORs 'Technological collaboration reasoning' and the 'Experience in partner identification propensity'. The ability of the firm to predict the industrial technological path and, therewith, to identify the future customer requirements and to convince them in their future strategy, provides the grounds to both partners for differentiation, i.e., gives the reason to collaborate. Such collaboration secures the strategic relationships and alignment of partners' businesses [1], [16]. The experience in performing such a task enhances the new team's expertise, i.e., the resources necessary to gain organisational credibility [1], [2], [16]. Hence, these BORs together with the new cultural BOR, construct the COR 'Integration and alignment with industry's strategic partners. Note, that the new knowledge COR 'Pro-active product innovation competence' also influences the organisation's credibility in its strategic relationships building, i.e., the relational COR 'Integration and alignment with industry's strategic partners'. For instance, if the organisation does not exhibit the profound knowledge of the industry and its technological trends, i.e., does not provide the credible reason for cooperation, the future strategic players may build the partnership/alliances with other players.

Hence, at least two CORs have been detected to form the IOR 'Organisational entrepreneurial proclivity capability'. This IOR belongs to the capability level because of its construction not only implies on the inter-functional cooperation, but also requires the collaboration and alignment of activities of multiple parties, such as internal and external (e.g., customer) strategic teams. Thus, this IOR is critical for building an isolating mechanisms to sustain a competitive advantage since the relationships with the key players in the industry means pre-emption the relational resource base [1].

Hence, the analysis of FEM models with focus on intangibles, may be interpreted as the introduction of a new department complements the existing product development competence with the processes, potentially, capable of advancing the intangible resources' base to sustain a competitive advantage. For instance, despite having IOR in place to ensure the superior innovation competence, the company has been losing its strategic position and suffering financially. This discourse can be explained by the notion of double resource hierarchy. Namely, according to the general resource development hierarchy, the organisation did not have the IORs at the organisational capability level, i.e., the most complex level of the resource application that

is responsible for the coordination and knowledge exchange organisation wise and inter-organisation wise [26]. The lack of the complexity and the ambiguity in the resource building imply on the vulnerability and/or unsustainability of the competitive advantage [34].

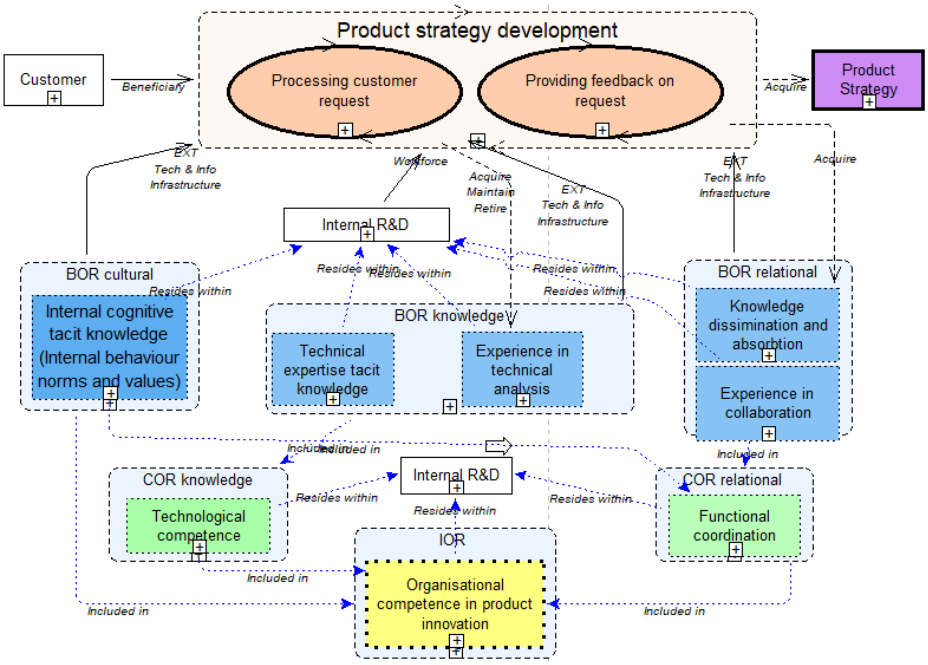


Figure 4: The example of the process decomposition from Figure 1 showing more details on the composition of the IOR before the structural change.

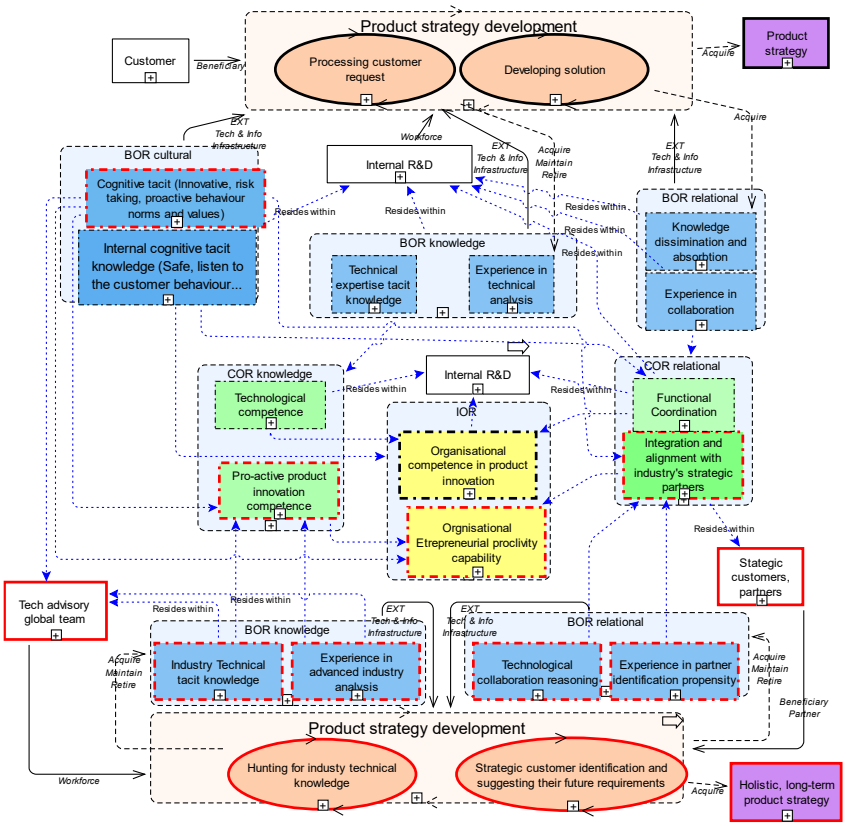


Figure 5: The example of the process decomposition from Figure 1 showing more details on the composition of the IORs after the structural change. (In red boarders including dotted - the assets and processes introduced after structural change).

The application of the proposed modelling technique to describe the organisation's situation enhances the analyses by providing better visual observation over the intangible resources' composition; hence, how to better manage them. Namely, the visualisation of intangible resource hierarchies' fusion may help the practitioners in development of difficult-to-imitate resource and strategy implementation through better understanding of the process-structure-resource relationships.

7. Lessons learned

The existing FEM modelling notations are sufficiently expressive to realise the conceptual methods to show the classification of the intangibles, the scope of the resource application and the resources complexity:

- Classification: although, there is none of the explicit notation in FEM toolkit to classify the intangibles into knowledge, culture and relational categories, the differnet colours can be effective for this purpose.
- Scope: The scope of the intangible resources application can be denoted by using the arrows, such 'resides within' connected to the tangible HR asset, e.g., the person, the team or the entire function (see examples in Appendix 1).
- Complexity: The complexity or the composition of the higher level intangibles can be denoted by using the assosiation links between multiple operant resources. However, to determine whether a higher-level operant resource represents a combination type (i.e., COR) or a reinforcement type (i.e., IOR), might be confusing. In this work, the following interpretation is adopted: the composition (COR) occurs when BORs are visible and acounted by different parties in their processes execution, which may change the value of the process outcome; while, the reinforcement occurs when BORs and/or CORs may also influence the business process outcome in such a way that produces different type of outcome.

The application of method has also helped to explain how the re-structuring may have improved the sustainability of the competitive advantage through building more difficult-to-imitate operant resources.

This study provides an alternative perspective on the intangible resource modelling for the strategic analysis but it is limited to the application of the one EM technique (i.e., FEM), the relatively narrow scope of the intangibles' classification, and to a single case of application. The future research should aim at mitigating such drawbacks. The presented resource decomposition has been useful but it does not show how the combination occurs, i.e., what triggers the change in the pattern of the activities that acquire and combine those resources, such as organisational learning loops investigation. Also, a better understanding and defenition of COR and IOR resources is needed.

8. Conclusion

The aim of the study has been to propose and apply in a real case scenario a new duo-hierarchy modelling method for analysis of intangible resources. To reach the aim, the enterprise modelling, FEM in particular, has been employed. The proposed method provides an alternative idea for how to approach patterning of the intangible resources. From the practical perspective, the method has been useful in explaining the strategic discourse from the intangible resource perspective. In particular, it has been shown how the intangible resources and their configuration contribute to the strategy implementation. Through modelling aspects, such as the operant resource acquisition, usage, parties of possession and their composition, it has been possible to identify the intangible resources that may facilitate and/or inhibit the strategy implementation in practice. Also, it has been possible to illustrate how an organisation may address the strategic issues by adjusting its resource base through the re-structuring.

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