DOTK: Descriptive Ontology for Territorial Knowledge for Sustainability

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Abstract—Ontology is a useful method that can share a common understanding of the structure of information, make domain assumption explicit and analyze the domain knowledge. Representation of territorial knowledge based on the ontology is an approach which explains the nature and reasoning of this knowledge for sustainability. This paper proposes a descriptive ontology for territorial knowledge (DOTK) based on foundation ontology. DOTK ontology is an ontology of domain and its aim is enhancing the sustainable knowledge of actors within industries according to territorial knowledge. Extracting the concepts of the domain is from scientific study. This ontology is a guide for contracting of operational ontology and semantic graph demonstrate the rules between concepts of territorial knowledge. This work is ongoing research for applying of this ontology in the special domain. This study will be considered which part of DOTK and how can help to actors of hierarchical level within industries.

Keywords—ontology, territorial knowledge, the descriptive ontology for territorial knowledge (DOTK), sustainability

I. INTRODUCTION

The territorial dimension should be taken into account adapting global policy to local specification to develop the appropriate solution for sustainability [12]. Moreover, the growing attention given to sustainable development is encouraging companies to integrate sustainability issues into their activities in different hierarchical level from strategic decisions by top management, planning by tactical management, to the daily operational area [37]. In addition, discovering of territorial resource can assist in the implementation of sustainability within industrial companies. In order to the implementation of sustainability, it needs to break down it into several attributes to help its comprehension [17]. In this research definition of sustainability with 5 dimensions has been adapted. Sustainability objectives focus on human development (social sphere). The environment is investigated as the limiting factor for anthropic activity (ecological sphere). The economic sphere is considered as means which enable the realization of the social objective with respect to ecological conditions. The political sphere is considered as the place for long-term societal orientation and decision making; i.e. and expectations from civil society. The territorial dimension as a resource flow can provide the value for human and industrial companies [1]. Also, Literature review is demonstrated which there is not enough knowledge about the territory’s feature. So, it is barriers to research possible concept for improving sustainable objective within industries. Therefore, this question is emerged which type of territorial knowledge and in which method can help actors of the hierarchical level. Moreover, an ontology which can facilitate information sharing and exchange in the various engineering domains by providing concept structures and clarifications that make explicit and precise important notions [11]. In this research, it is assumed that foundational ontologies, such as DOLCE, can make explicit territorial knowledge notions in the various hierarchical level of industries to increase sustainable performance. So, a descriptive ontology for territorial knowledge (DOTK) based on Ontology DOLCE is proposed which is an ontology of domain. In addition, the concepts of the domain of territorial knowledge for sustainability are extracted from the scientific study by text mining. In another word, it is identified an ontology of domain base on the scientific study. This ontology argues on the concept of territorial knowledge in different entities such as perdurants, endurants and abstract. Also, demonstrate the nature of this concepts to help the performance of sustainability. The aim is improving knowledge of actors within industries about their territory for better implementation of the sustainable objective. This work is ongoing research to apply this ontology to the real example of sustainability and building an operational ontology finally.

II. TERRITORY

A territory is considered as value creation network for human where all of the intangible and tangible resources flow [12]. Also, it is involved the combination of a set of actors that in which human activities occur and the geographical space that this actors use, landscapes and manage [26]. It needs to define the notion of the intangible and tangible resource of territory. Moreover, discovering territorial notions, as territorial knowledge, can help to the implementation of sustainability. Sustainability issues affect every component from individuals to regional and global organizations: major ecological or social crises are due to natural resource overconsumption and rising inequality at both local and global scales [2]. The sustainable strategy is not an independent issue in corporate global development and it should be concentrated on other global tendencies and concentrates in industries [17]. Therefore, it is needed to depth understanding of semantic and structure of territory from different implications for the sustainable objective in industrial companies. The territorial dimension should be considered, adapting global policy to local specificities to develop appropriate solutions [26]. So, it is categorized four aspects of territory according to the local specification in the literature review for the sustainable objective in the industrial companies. These four types are Human, Geographical, Economic and political capital.

Human development is one of the sustainable objectives in the territory. Human capital is defined as ability, to innovation ability and organization, individual skills, creativity, experience, ability to work in the team, motivation, learning, etc. [13]. The geographical system is considered as action
perimeter and is the based system including physical features of the earth, atmosphere, resource, infrastructure and socio-ecological activities [9]. Economic sphere is defined as a mask which enable realization of the human capital objective with respect to the ecological boundaries to create the value. Role of economic capital is to increase the efficiency and productivity of local activities [6]. The political sphere is the only legitimate arena to define development guidelines and must find a prominent place and take precedence over economic actors. In fact, public policies are the only legitimate way to define public interest and the common good; consequently, they must coordinate sustainable industrial strategies and expectations from civil society [7]. Therefore, these dimensions of territory are as promising perimeter which consists of the main elements of tangible and intangible resources for sustainability. These dimensions can be represented in an ontology which can facilitate information sharing in the various engineering domains by providing concept structures and precise important notions.

III. ONTOLOGY FOR TERRITORY

An ontology is a formal, explicit specification of a shared conceptualization. Basically, the role of ontologies is to facilitate the construction of a domain model. An ontology provides a vocabulary of terms and relations with which to model the domain [16]. Ontologies are quintessentially content theories because their main contribution is to identify specific classes of objects and relations that exist in some domain [11]. Thus, the first step in devising an effective knowledge representation system is to perform an effective ontological analysis of the domain. Second, ontologies enable knowledge sharing [8]. Ontology’s structure consisting of a set of concepts, a set of relationship connecting concepts, a set of instances assigned to a particular concept [15].

Therefore, as explained about the definition and advantage of ontology, it is a useful method to represent territorial knowledge for the sustainable objective in industries. It helps actors of industrial companies by facilitating the exchange of entity of territorial knowledge. So, a territorial knowledge ontology is proposed in this research. Thus, at first, different territorial ontology and sustainability ontology will be considered. This consideration assists to compare different notions which other researches investigated in comparison with the notions of territorial knowledge.

IV. RELATED WORKS

The efficiency of sustainability assessment depends on the available knowledge of the ongoing capabilities and there is not knowledge systematization in the sustainability assessment domain. Some of the researches considered an ontology-based knowledge modelling for sustainability. The aim in this section is to compare territorial knowledge taxonomy (mentioned in section II, as an ontology-based knowledge of sustainability, with other research of sustainable and territorial ontology to identify the intention of each ontology. Moreover, it will be considered the objective, construction, and level of each ontology comparing with our territorial knowledge for sustainability. This comparison assists to understand, how are constructed other ontology for sustainability and whether other research clarify the entities of sustainability in different foundation ontology to improve actors’ knowledge of sustainability within an industrial company or not.

Reference [31] proposed the ontology that enables to describe of strongly sustainable business models, as validated by ecological economics and derived from natural, social, and system sciences. Governance, stakeholders, natural resource, social impact and expectations, satisfaction and capability are taken into account to construct this ontology. Moreover, it cannot be seen that how the available element link to other elements of sustainability. This ontology is valued, not only to the groups of stakeholders (leader and manager in the company) but also to those outside the realm of business, such as public policy analysts and educators. It was not considered all of the aspects of sustainability as political and geographic views [31].

Another research provided formal, practical and technological guidance to a knowledge management-based approach to sustainability assessment [19]. The aim is the improvement of understanding of interactions between natural and social systems to guide these interactions toward more sustainable trajectories. It provides complete domain knowledge of sustainable assessment solutions which can be directly applied by the experts in the process of sustainable assessment evaluation. This ontology is constructed by specification includes the criteria and sub-criteria: domain of usage as production and manufacturing sector, issues as environmental impact and dimensions, scope as assessment, receivers as a company. But, several missing can be seen in this research about territorial knowledge. Moreover, it is not cleared to understand each subclass to be in which section of sustainability (environmental, social or economic). Also, the entity of sub-classes of sustainable ontology is not identified from a particular or universal point of view.

In addition, other research considers the multidimensional views for sustainability by territorial knowledge as an ontological approach that it will be showed their intentions for an ontology of sustainability in table 1. Analysis of table 1, based on literature review, show some of main ontological based territorial knowledge for sustainability. This table represents the construction of each ontology and it is clarified the level of entities in foundation ontology.

As a result, it can be concluded that the most of other researches consider only three aspects of sustainability (environmental, economic and social) and some of them only three aspects of sustainability (environmental, economic and social) and some of them only consider the environmental aspect of sustainability by integrating some parameter of economic and social in their ontology. For example,

<table>
<thead>
<tr>
<th>Reference</th>
<th>objective</th>
<th>Main concepts</th>
<th>Level of ontology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wijesori, C. et al., 2015</td>
<td>Develops ontology-based dimensional view to environmental management</td>
<td>Social aspects of environmental management, optimizing resource, social knowledge</td>
<td>Taxonomy for ontological views</td>
</tr>
<tr>
<td>Konys, A., 2018</td>
<td>The interaction between natural and social systems</td>
<td>Production, manufacturing, environmental dimensions</td>
<td>Formal description</td>
</tr>
<tr>
<td>Borsato, M., 2014</td>
<td>Facilitate the use of sustainability through the product's lifecycle</td>
<td>Product, process, data, organization, material</td>
<td>Class process ontology</td>
</tr>
<tr>
<td>Liu, J et al., 2013</td>
<td>The balance between economic benefits and environmental protection by ontology</td>
<td>Product, organization, and process environment (ecology)</td>
<td>Ontology-based on design</td>
</tr>
<tr>
<td>Upward, A et al., 2016</td>
<td>Ontology-based on sustainable business model</td>
<td>Product and development, governance and industrial ecology</td>
<td>Relationship diagram generally</td>
</tr>
</tbody>
</table>

TABLE I. | concepts of territorial ontologies of other researches for sustainability |
Reference [23] provides an ontology-based process-oriented framework to support product development with the environmental concept and make a balance between the economic benefits and environmental protection.). All aspects of political capital, almost, are not taken into account in the most of researches of ontology for sustainability. Moreover, most of the parameters of sustainability are extracted generally and some works such as [4] who propose an ontological based that it is related to specific terms of sustainability [4]. So, it can be concluded, there is a lack of some dimensions of territorial knowledge for sustainability and it can be proposed a comprehensive ontology of territorial knowledge toward sustainability.

Therefore, an ontology-based of foundation ontology according to the territorial knowledge will be proposed. This ontology will be useful for semantic web and specific application within industrial companies. Thus, the relationship between different entities assist the actors of the hierarchical level to find which type of territorial knowledge ontology effect on their activities in industrial companies toward sustainability. So, Modeling of territorial knowledge in ontology will be proposed, it is called Descriptive Ontology for Territorial Knowledge (DOTK).

V. DESCRIPTIVE ONTOLOGY FOR TERRITORIAL KNOWLEDGE

Ontologies exist in many forms. Roughly, ontologies can be divided into three types (i) foundational ontologies, (ii) domain-specific ontologies, and (iii) task-specific ontologies. Foundational ontologies to provide conceptualizations of general notions, such as time, space, events and processes. Domain-specific ontologies that they are intended for sharing concepts and relations in a particular area of interest. Task-specific ontologies are the third class of ontologies specifies the conceptualizations that are needed for carrying out a particular task [27]. In this research, our focus is on the foundation ontologies to describe the territorial knowledge for sustainability. The methodology of construction of this ontology of domain has three steps. At first, conceptual categorization of territorial knowledge and their sub-concepts are identified from the literature review. Secondly, foundation ontology is considered that it is related to specific terms of sustainability. Then, top-level ontology according to the conceptual categorization of territorial knowledge is specialized and ontology of domain is created.

A. Taxonomies of Territorial Knowledge

Four main taxonomies of territorial knowledge have been introduced in section two and each taxonomy has different sub-concept. So, these sub-concepts should be presented for constructing of DOTK. The aim is to illustrate the important concepts of each taxonomy which will be considered in the DOTK ontology.

Intellectual capital (IC) as a taxonomy of human capital, is used to create and use knowledge to increase the industrial value. IC links to the knowledge management in the organization of the company through the knowledge, competencies to improve the organization process and ability to innovate. Sharing of knowledge in network improve the learning process within companies and between actors [18]. Moreover, the combination of knowledge and competencies influence the organizational selection of environmental strategies on sustainability efforts and search for the greener business model [29]. Innovation as a skill of intellectual capital not sufficiently valued in the strategic level because don't inform the strategic decision making that must be taken into account through knowledge management and governance in the company [2]. Individual and groups as a stakeholder can be influenced by the organization and they need in the strategic help to sustainability in different industries' hierarchical level and their expectation should take into account in decision making [37]. Identification of the organizational filed should be considered to create a commitment to the desired changes for sustainability. Sharing of value for customers is created by the network that supports the design activity [1], geographical information system (GIS) is another main important element for industries which can help product designers to analyze the environmental impacts before and after design, which change design characteristics and product specifications based on the environmental status of each geography [32]. In addition, the process of the organization and coordination of actors improve territorial cohesion at different hierarchical levels [30].

Economic capital creates the value for customers by use of an artefact and by optimizing production cost and strategic positioning in the value creation for industrial companies. The aim of the service economy is to create value by adding service to products. Value for the client as human capital is created via the multiplicity of service associated with an inexpensive good by the company and for the company is created by the maintenance of the lowest production cost [1]. Mass consumption is the base of the market economy. The value for the clients is created by the possession of a rewarding object such as brand. The value is created for the company by the desirability of products and reduction of production costs. The quaternary economy's goal is to create value for the clients by customizing the response to his specific request. The company creates value in the quaternary economy by tailoring a panel of products and services that meet client expectations [9]. The economy of functionality creates the value for the client by the satisfaction of a level performance supported by product- service pair [2].

Geographical capital compartmentalizes into the eco-sphere, infrastructure and environmental geography in our territorial knowledge ontology. Eco-sphere refers to the human-environmental systems. Environmental geography is the interaction of humanity and environment and defines as space for the circulation flow [36]. Infrastructures act as fundamental facilities to improve the productivity of existing resources [25]. The natural resource is described all of the input flow from eco-sphere that enter to the techno-sphere [36]. Substance flow is considered a key factor to evaluate the resource consumption and environmental impacts. Substance flow can flow within the techno-sphere, and between techno-sphere and eco-sphere and their environmental impact should be taken into account by industries through product lifecycle in the geographical system. Techno-sphere refers to global technology system integrating all human activities [32]. Technology is another sub-cluster of infrastructure that enhances the productivity and flexibility with supplier and customers that environmental impact of the product can be clustered as four types: production phase, transport phase, use phase and disposal phase by human or industry [36]. Moreover, the Supplier is presented as an external network of value creation for industries [2].

In the political sphere, governance principles are in order to facilitate coordination between political, territorial
knowledge and company sphere [5]. It must be adapted by integrating the multiplicity of stakeholders (individual and groups) and their expectation in taking decision compatible regarding existing rules [1]. The principle of governance such as capability, democracy, council and administration in different scales (local, regional, national and international) support the industrial organization for the sustainable objective. Democracy aims to create a balance between individual preferences and the common interest in meeting the challenge of sustainable development in the company. Capability improve the development of the capacity of organizations/individuals to meet their own expectation and decision making level and level impacted Strategic governance concerns decisions help to top managers and giving the value to the initiatives at the strategic level that come from operational level [2]. The political elements are taken into account in the strategic level of industry concerning to governance.

B. DOLCE Ontology

Foundational ontologies are ontologies that: (i) have a large scope, (ii) can be highly reusable in different modelling scenarios, (iii) are conceptually well founded, and (iv) are semantically transparent and richly axiomatized. Moreover, foundational ontologies focus on concepts (like the concepts of object, event, quality, role) and relations (like constituency, participation, dependence), that are not specific to particular domains but can be suitably refined to match application requirements. It provides a starting point for building new ontologies and supply a reference point for rigorous comparison among different possible onto-logical approaches [27].

The special class of ontologies is formed to be reused and extended for a particular domain to form a domain ontology. DOLCE (Descriptive Ontology for Linguistic and Cognitive Engineering) is in the categories as a resource for designing knowledge system belong ontologies and formal description of the structure of knowledge bases. SUMO (Suggested Upper Merged Ontology) is another foundation ontology that organized into a single hierarchy rooted at the entity, representing the most general concepts. According to DOLCE, different entities can be co-located in the same space-time. [24]. DOLCE ontology allows to different entities to be co-located in the same space-time while SUMO is its relatively low coverage that does not allow for open-domain applications. Moreover, DOLCE uses the simplest quantified model logic and it serves as a foundation for a drivers range of ontologies in different subject areas [10]. So, DOLCE ontologies can be used to show the conceptualization of territorial knowledge and their relation for the sustainable objective in industry.

DOLCE is the first module of a library of foundational ontologies and idea is to make the rationales and alternatives underlying such choices as explicit as possible, as a result of a careful isolation of the fundamental ontological options and their formal relationships [14]. DOLCE is based on a fundamental distinction between enduring and perduring entities and abstract. Perdurants just extend in time by accumulating different temporal parts, so that, at any time they are present, they are only partially present, in the sense that some of their proper temporal parts may be not present. Endurants are wholly present at any time they are present. perdurants are extended in time such as event and process. The abstract includes both object-level concepts, such as set, time, and space, and meta-level concepts such as attribute and relation. From the corresponding goals, abstract "is a general concept formed by extracting common features from specific examples" [14]. The taxonomy of particulars assumed in DOLCE includes, for example, abstract quality, abstract region, agentive physical object, amount of matter, non-agentive physical object, physical quality, physical region, process, temporal quality, temporal region [24].

In this research, DOLCE ontology is selected for construction of descriptive ontology for territorial knowledge because it allows us to concisely model the relationship between entities of territorial knowledge for the sustainable objective in industries. Moreover, DOLCE is an ontology of domain and it represents the role and nature of objects in a reasoning. So, it is a useful method to show the ontology of domain of territorial knowledge.

C. Construction of Descriptive Ontology for Territorial Knowledge

Substantial and Quality are two main categories of endurants. Qualities can be seen a basic entity that it can be perceived or measured. Substantials are state aggregates of qualities but are not themselves qualities. In another word, they are physical and non-physical with spatial qualities. The main characteristic of objects is the endurants with unity. However, as different subtypes of objects may have different unity criteria [14]. Perdurants comprise events, processes, phenomena, activities, and states and it takes into account two basic aspects: change and homeomericity. Moreover, abstract seems to fit the terms such as attribute, relation, and possibly hyponyms of quantity.

There are different elements in the territorial knowledge taxonomy which they can be categorized in different classes of abstract in DOTK ontology. Moreover, it is useful in industries for the sustainable objective. Because, categorizing of territorial knowledge in DOTK help actors to understand the nature of this knowledge in this ontology. Actors can easily understand how different territorial knowledge are linked together by showing the nature of these links. Semantic representation shows the role and nature of objects in a reasoning while a process shows the "how" of reasoning. Figure 1 shows the territorial knowledge relationship that identified as abstract according to their definition.

Categorization of perdurants identifies the territorial knowledge such as event, stative phenomena, internal change, etc. In other words, it is the clarification of the temporal and spatial parts of territorial knowledge and most of the territorial knowledge entities are placed in the stative. Moreover, some of the subclasses of political capital are in event entities particularly. Territorial knowledge entities are demonstrated as perdurants in figure 2.

Also, there are many concepts of territorial knowledge which adapt to the endurants entity. Endurants are wholly present at any time which they exist as the physical object. Most of the subclasses of geographical and human capital are located in endurant entities as quality and substantial according to their definitions. In addition, substantial cover most of the political and economic concepts and sub-concepts. Figure 3 depicts some of the territorial knowledge associated with endurants of DOTK ontology, either in the domain or a range of role. Attaching the taxonomy of territorial knowledge to ontology will be useful for entities of territorial knowledge specific application in the industrial organization. DOTK ontology represents the role of ontology as a meaning of vocabulary. This vocabulary can account for the necessary semantics in order to establish seamless, unambiguous information
sharing from territorial knowledge within hierarchical levels of industries. Moreover, DOTK ontology provides more details about the notion and intention of territorial knowledge taxonomy for sustainable objective to help the actors of industries. In the next section, the semantic graph will be presented in order to identify the relationship between territorial knowledge concepts.

D. Semantic Graph of Territorial knowledge ontology

Ontologies are useful to organize the semantic information and support using inference tool to discover new knowledge [35]. Different categorizing of DOTK assist to understand the nature of territorial knowledge. Also, it is identified the territorial knowledge which has the same entity and similar level in perdurants, endurants and abstract.

The goal is to show the relationship of territorial knowledge concepts together and the link between them. This semantic representation demonstrates the "why" of reasoning for territorial knowledge ontology "DOTK" to help the actors of the hierarchical level. So, actors of hierarchical level within industries can understand the influence of different concepts on each other via attribute between concepts.

Figure 4 demonstrates the semantic graph of the relationship between “DOTK”. Concepts of territorial knowledge in this graph are in a high level of ontology "DOTK" through attribute between concepts. So, analysis of this graph is according to the relationship between all sub-class of territorial knowledge which placed at the level of stative, event, substantial, quality, region, attribute, and action. This semantic graph is linked to the existing scientific work in territorial knowledge domain for sustainability.

Analysis of this semantic graph is started with democracy. Democracy as a class of political capital build a balance between individual preference and the challenge of sustainability in industrial companies and this balance is made by governance. Industries use the governance to facilitate coordination between territory and companies sphere and organization.

Communication in the organization, coordination between politic and company, innovation and integration of stakeholders (individual/social capital) assist to the governance in strategic and operational of the hierarchical level. Communication between different level of industry help to strategic level to give the value to the innovations. Political sub-classes are considered for long-term social orientation and decision making in companies and realization of the social objective is possible by economic capital as a means. Service and logistic foster the market as economic capital to share the value for social capital by governance decision making. In this regards, intellectual capital is used and coordinated in the organization of industries for governance decision making.

Industries for the objective of human development need to use the natural resource with respect to the ecological sphere. Natural resource come from eco-sphere and industrial activity have the ecological influence, such as emission and disposal waste, on the ecosphere. Moreover, a flow is a kind of substance that enters or leave from a process an environment and this substance has the property and quantity [36]. So, substance flow ontology has sub-class such as product flow that uses the natural resource. Products are one of the outputs of substance flow as a physical object. Thus, Geographical information systems (GIS) help to analyze the environmental impacts of product specifications based on the

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**Fig. 1.** Entities of DOTK ontology in "abstract"

**Fig. 2.** Territorial knowledge in “perdurants” entities of DOTK ontology
environmental status of each territory such as local industries [32].

In order to better understanding of the semantic relationship between other concepts of DOTK ontology, another graph is considered other concepts which are categorized in deeper classes of DOTK according to their nature. This graph considers the property between concepts which located in the physical and non-physical region, aggregate, agentive physical and non-agentive physical object, non-physical object, agentive and non-agentive social object, process and achievement. This graph is showed in figure 5.

Therefore, the widespread relationship between concepts of territorial knowledge ontology is demonstrated in these semantic graphs. these graphs can assist actors of industries in order to better realizing of impacts between concepts and rule of relationships. So, it is useful for integration to their activities for a sustainable objective.

In the next section, construction of DOTK ontology with other available ontologies will be compared theoretically.

VI. APPLICATION OF DOTK ONTOLOGY

DOTK ontology categorized the different concepts of territorial knowledge in abstract, perdurants and endurants entities for the goal of sustainability. In fact, this work, at first, create a taxonomy of concepts, then proposed the semantic graphs of relationship according to the position of each entity in the DOTK ontology. Some other theoretical works, proposed the ontologies as same of DOTK ontology but it can be seen some missing in their work and construction of their ontology. At first, other works will be explained in order to compare with DOTK ontology. Secondly, apply of DOTK ontology in the special domain will be considered.

A. Compare of DOTK Ontology with other Sustainability and Territories Ontology

The aim at the different research of ontology is providing a structure for knowledge of concepts and to constrain their intended meaning formally. They comprise only concepts and relations and to be applied to a specific domain. Moreover, these researches need to be enriched with the appropriate domain- dependent concepts and relations.

Reference [21] proposed a descriptive ontology that focuses on the sustainable design of the socio-ecological system to describe a framework by means of ontology. The framework is instructed according to the social, economic, political setting, ecosystems, and resource system. The domain concept, as top-level, class is divided into the attribute, quantity, abstract object, concrete object, substrate, and spatial region classes [21]. There are some missing of concepts in its framework in comparison to our work from taxonomy point of view, particularly in sub-concepts. There are missing sub-concepts in the ecosystem such as infrastructure, type of resource, transport and human activities consequence. Moreover, human capital such as intellectual capital, communication, knowledge management, human resource, and culture didn't be considered. Other missing sub-concepts such as service for client, quaternary economy and functionality in economic capital can be seen. Also, democracy, capability, and scale of governance are not clear as political sub-concepts in this research. Moreover, this research mixed the classification and semantic graph relationship together. So, at first, the distinction between different taxonomy is difficult. Secondly, this foundation ontology doesn't present the semantic relationship graph of different concepts and sub-concepts and their attributes.
In another research, global system for sustainable development ontology is considered [22]. Political concepts and sub-concepts such as rule, governance, etc., and economic concepts such as marketing and client satisfaction are missed completely in this research. Also, Concepts such as organization, intellectual capital, and social concepts and their sub-concepts didn't be investigated wholly. This work only focused on the concepts of geographical capital from an environmental point of view. The sustainability ontology is defined concepts strictly with concepts for part-relationship and for attribute-relationship.

A formal knowledge representation language in the form of a logic-based ontology is presented by [20]. Concepts such as technology, production facilities, infrastructure and material transportation, and waste flow in regional scale are investigated in this work. Lack of economic and human capital's concepts can be seen in this article. Governance as a politic concept is taken to account only there is a lack of other concepts of politic. Other concepts of geographical concepts such as ad infrastructure, human activity, supply, energy, product, emission, and resource are argued in this ontology. So, it is proposed a knowledge model based only on the graph of the semantic statement describing the geographical capitals. Moreover, there is not any classification in the sub-concepts of sustainability knowledge.

These examples were some sample of the ontology of sustainability which investigated the concepts of sustainability. As explained, there is a lack of some concepts in other research that won't be taken to account. While, in our research, at first, the complete taxonomy of territorial knowledge is created for the sustainable objective. Then, according to the position of concepts and sub-concepts in the DOTK ontology, the semantic graphs of relationship are proposed. These graphs show the attribute between concepts which they are located at the same level of DOTK ontology. Advantages of our research in comparison to other work are, firstly, creation complete taxonomy, as tree flowchart, of territorial knowledge for sustainability. Secondly, the semantic graph is as a guide to help understanding of semantic statement describing. Thirdly, the position of territorial concepts is considered in low-level of perdurant, endurant and abstract entities in DOTK ontology. In other work, there are missing some concepts in their taxonomy. Moreover, the classification of concepts and semantic graphs are mixed together that it is not in heritage. In the next section, applying of this ontology in the specific domain will be considered.

B. Apply of DOTK Ontology in Special Domain

Ontology could be considered in conceptualization level and operational level. At conceptualization level, ontologies are mean to investigate knowledge and clarify the relationships between resources and concepts. At the operational level, ontologies' main role is to allow a fluent dataflow between heterogeneous environments [24]. The goal of this research is the construction of ontology for putting on the software. So, DOTK ontology will be applied in the special domain to validate the entities of our ontology by the real case. An example of this construction is in the domain of agriculture. F. Zahm et al. proposed a conceptual framework based on key properties relating to the sustainability in agriculture by investigation of real cases in France [34]. In this research, at first, theoretical framework, related to the strong sustainability with is proposed. Then, assess of sustainability to achieve in Argo-ecological, socio-territorial and economical terms of sustainability will be implemented by real cases. Figure 6 shows some concepts of sustainability in agriculture of real case that is put in the perdurant entities of DOTK.

So, apply the concepts of DOTK in this real case allow to find a certain element that should be represented. it needs to other elements that didn't be considered in DOTK ontology, it is ongoing apply of DOTK ontology in the real case of agriculture to helps the actors in order to better understanding of reasoning of concept and validation of DOTK ontology.

VII. CONCLUSION

Sustainability requires a semantic approach in order to understand the relation of concepts of territorial knowledge for local and regional territory. Moreover, lack of territorial knowledge is funded as a barrier for searching for useful concepts of sustainability within the industrial company. So, territorial knowledge concept and sub-concepts based on 5 dimensions of sustainability are categorized as tree flowchart in the literature review. Foundation ontology such as DOLCE can facilitate comprehension of territorial knowledge concepts and nature of this knowledge for actors of hierarchical levels for implementation of sustainability via formal explicit of the shared conceptualization. Therefore, a descriptive ontology for territorial knowledge (DOTK) based on DOLCE ontology is proposed. Construction of this ontology is done through adaptation of concepts of territorial knowledge with perdurants, endurant and abstract entities. DOTK ontology represents the "why reasoning" of each entity of territorial knowledge as a guide to help the actors of hierarchical level within companies. This proposed ontology
in this step is an ontology of domain. Moreover, the semantic graph demonstrates the attribute between concepts of DOTK ontology in top-level and low-level for the understanding of their relationship and rule between concepts. In addition, DOTK ontology is compared with other ontology of sustainability theoretically. It is proved that it consists of the complete taxonomy of sustainability and semantic graph as a guide to help comprehension of semantic describing. Moreover, the position of concepts in this ontology is considered. While in other research, there are missing this steps.

This work is ongoing research. In future work, the application of this ontology in the real case will be considered. The goal in future work is proposing of application ontology. In another word, each concept of DOTK ontology is a guide for constructing of application ontology in a special domain. Moreover, it will be investigated that DOTK ontology can assist to which hierarchical level within industries.

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