



D2.1 OPTIONS FOR THE KNOWLEDGE FRAMEWORK

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Executive summary

Deliverable D2.1, “Options for the knowledge framework”, aims at presenting some methodological options for the development of the Knowledge Framework on which the whole Project will ground its activities. The presentation relates to the meta-structure of the Framework and its degree of formalization, together with a development strategy on the informal and semi-formal knowledge elicitation and description methodologies and tools and the set of research methodologies that will be adopted.

The first stage of Project’s activities showed the complexity of DiDIY, intended as a so multi-dimensional and dynamic phenomenon that any clear-cut, strict set of definitions would not be able to capture all its relevant aspects and their inter-relations.

This deliverable is coordinated and submitted together with D2.2, “Foundational interpretation of DiDIY”, devoted to a first content-related analysis of DiDIY.

Revision history			
Version	Date	Created / modified by	Comments
0.0	15/04/15	LIUC	First, incomplete draft, resulting from several online documents to which all partners contributed.
0.1	23/04/15	LIUC	Extensions, fixes, etc. First formal distribution to TB.
1.0	30/04/15	LIUC	Fixes after comments by TB members. Approved version, submitted to the EC Participant Portal.



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1. Introduction

1.1 Context and aims

WP2 is aimed at grounding all activities of this Project through a Knowledge Framework (KF) on the phenomenon that we have called “digital do it yourself” (DiDIY). The KF will be released as a sequence of three deliverables, in the form of public reports – D2.3, D3.4, D2.5, “Knowledge framework, initial / revised / finalized version” – at Months 6 (June 2015), 15 (March 2016), and 30 (June 2107) respectively.

As stated in the Project proposal, and now in the Grant Agreement (GA), the KF will provide “a common conceptual and lexical ground to the activities performed in all other WPs by integrating the different competencies of the interdisciplinary Project team, in particular by harmonizing languages, approaches and research methodologies”. The sequence of KF versions will allow us “to timely update the shared framework and validate the hypotheses grounding the previous versions of the framework”.

Not necessarily the KF will have to include formal definitions, and it might be instead organized as a more or less structured set of “dimensions” (e.g., the importance in DiDIY of creativity, the interest in DiDIY for self-actualization, the role of communities in DiDIY for information and knowledge sharing, ...), introduced and at least preliminarily explored because thought to be relevant to characterize DiDIY and therefore intended as viewpoints on it to be better understood, and possibly to be exploited in related decision-making processes.

Given the complexity of the phenomenon under consideration (in principle both a spatial and a temporal complexity: has DiDIY the same connotation in UK and in Italy? in Europe and China? ten years ago and today?), at least in the initial release of the KF its openness should be privileged over its specificity.

In order to identify an appropriate development process for the KF, two coordinated deliverables have been planned to be delivered at Month 4 (April 2015) (quotations below are from the GA):

- D2.1, “Options for the knowledge framework” (*the present document*), in which some methodological options for the development of the KF are explored, relating to “the meta-structure of the framework and its degree of formalization”, and a development strategy is identified, relating to “informal and semi-formal knowledge elicitation and description methodologies and tools” and “the set of research methodologies that will be adopted”;
- D2.2, “Foundational interpretation of DiDIY”, based on the acknowledgement that “the paradigmatic novelty of DiDIY and its multifaceted nature require a cultural shift spanning, with mutual dependencies, the three layers of the individual, the organization, and the society” and aimed at identifying “the multiple dimensions according to which DiDIY can be interpreted” and therefore at defining “the structure of the framework that will be then developed and validated in the subsequent tasks of the WP”.

1.2 Terms and acronyms

GA	Grant Agreement
DIY	do it yourself



DiDIY	digital do it yourself
KF	Knowledge Framework

2. Justification: a complex subject

Several Project members, from all partner institutions, actively contributed to the WP2-related discussion so far, and partially different positions emerged on the possible options to characterize DiDIY, starting from the very meaning attributed to the terms in the expression “digital do it yourself”:

- what does *digital* actually refers to? how does it specify DIY?
- is the *doing it* focused on the production of physical artefacts or does it include services, purely informational entities, etc?
- how does the *yourself* change when the individual DiDIYer is in interaction with others, or becomes an organization or even the society?

The nature itself of DIY, and then DiDIY, has been challenged:

- is it a *method*? (as stated in wikipedia: “Do it yourself, also known as DIY, is the method of building, modifying, or repairing something without the aid of experts or professionals.” [http://en.wikipedia.org/wiki/Do_it_yourself])
- is it a *mindset* realized in a *set of behaviours*?
- is it a *process* or an *activity*?

And from the methodological point of view:

- is it appropriate to propose a *definition* of what DiDIY is?
- or is a weaker, maybe fuzzy, *characterization* sufficient for the Project’s purposes?

And:

- should such definition or characterization be the result of a *top-down process*? (from theories and models, possibly taken from literature)
- or is a *bottom-up process* more effective? (from cases socially acknowledged to be examples of DiDIY)

WP2 has been designed as the context to work on these both content-related and methodological issues, and therefore to set the stage for the whole Project in the form of the KF.

In order to identify an appropriate degree of formalization for the KF – from strong options such as a full-fledged ontology to weak options such as an unstructured collection of viewpoints – both a top-down analysis and a bottom-up exploratory analysis have been preliminarily performed:

- top-down exploratory analysis, through a literature analysis on DIY: the results are reported and commented in the coordinated D2.2, “Foundational interpretation of DiDIY”;
- bottom-up exploratory analysis, through a simple poll launched at the beginning of the activities of the Project, on 8 February 2015, open to Project members and aimed at gathering information on the preliminary understanding about what digital DIY is in terms of some exemplary cases; the results are reported and commented in Annex 1.



The data coming from both the literature analysis and the poll have been considered as a further confirmation of the complexity of the phenomenon: DiDIY is intended as so multi-dimensional and dynamic that any clear-cut, strict set of definitions would not be able to capture all its relevant aspects and their inter-relations.

3. The strategic positioning

DiDIY is not a natural entity, pre-existing to our models (as instead, say, tigers, water, and eclipses are). Rather, it is such a complex, dynamic, and fuzzy phenomenon that the quest of a single “true” meaning of what DiDIY is would plausibly be unable to grasp the multiple connotations of the phenomenon, thus producing the dangerous side effect of biasing the research activities and hindering the exploration of potentially interesting aspects and correlations.

The KF on DiDIY that will be developed is not aimed then at establishing what DiDIY is and what it is not, but at offering structured perspectives useful to better describe the phenomenon, to formulate explicative hypotheses, and on this basis to provide guidelines to exploit DiDIY as an effective means towards given targets. More explicitly, the KF will be then structured as:

- a *descriptive* model, in which the phenomenon is presented according to its main structural dimensions;
- an *explanatory* model, in which, building on the descriptive model, the phenomenon is interpreted according to some hypotheses on its determinants;
- a *prescriptive* model, in which, building on the descriptive and the explanatory models, the phenomenon is proposed as a tool to promote given social objectives.

<i>model</i>	<i>goal</i>	<i>possibly contributing to</i>
<i>descriptive</i>	the <i>what</i> of DiDIY	D2.2, “Foundational interpretation of DiDIY”
<i>explanatory</i>	the <i>why</i> of DiDIY	D2.3, D2.4, D2.5, “Knowledge framework, initial / revised / finalized version”; D3.2, “Integrative modelling (work and organization)”; D4.8, “Integrative modelling (research and education)”; D7.1, “Integrative models on the impact of DiDIY”
<i>prescriptive</i>	the <i>how</i> of DiDIY	D7.4, “DiDIY-related policy recommendations”; D8.6, D8.9, D8.10, D8.12, “Policy Factsheets, first / second / third / fourth version”



Building on the preliminary D2.2, “Foundational interpretation of DiDIY”, the KF will be developed in a series of three versions (D2.3, D2.4, D2.5, “Knowledge framework, initial / revised / finalized version”), to be delivered at Months 6 (June 2015), 15 (March 2016), and 30 (June 2017). As originally planned, the revised and the final versions will gather information from all other WPs: they will be richer in content than the initial version, but hopefully also more structured. The hypothesis of creating a fully structured KF remains as a possible target for the Project.

4. Conclusions

The research activities and the lively discussions so far have shown that it is still too early to design the formal specifications of a KF. Whether the KF will evolve up to become, e.g., a structured ontology is an open issue, that will remain actively explored in the development of the Project.

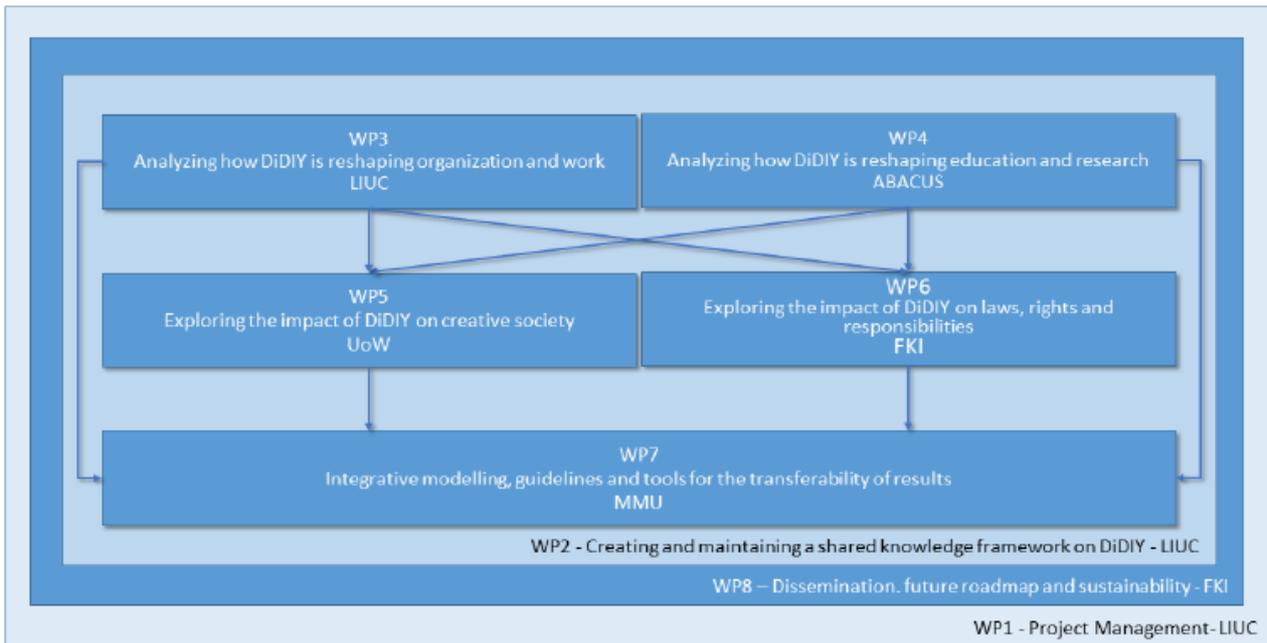
On the other hand, the target proved even more important than initially supposed for the WF to provide an organized context enabling the coordinated work of:

- analysis expected from WP3 and WP4, and;
- exploration expected from WP5 and WP6,
- as also supported by TT1 and TT2,
- and aimed at producing results for WP7 and then WP8,

as explicitly planned in the GA [Part B - 2.3.1. Work Plan]:



Project workplan concept.



Pert diagram

Such an organized context will be then developed by coordinating multiple (both exploratory and confirmatory) research methodologies, and exploiting both top-down (already proposed theories and models) and bottom-up (existing cases; data from questionnaires, focus groups, etc) sources. The fundamental goal is confirmed for WP2 to provide a shared ground for the whole Project.



Annex 1: A simple poll

At the beginning of the activities of the Project, on 8 February 2015, a simple poll was launched, open to Project members and aimed at gathering information on the preliminary understanding about what digital DIY is in terms of some exemplary cases.

It was presented with the title “Characterizing digital DIY” and introduced as follows:

<The very concept ‘digital DIY’ is complex, at least because multidimensional, and we need to make it clear and specific enough to allow us reaching significant outcomes from our analyses and explorations.

What follows is a bottom-up tool aimed at gathering relevant examples from all of us.

Claim: the following statements describe a situation that should belong to the scope of the DiDIY Project

(0: no idea; 1: strongly disagree – 4: strongly agree)

The “I” in each statement identifies a generic (individual but possibly also group / community) DiDIYer.>

14 Project members responded, at least one from each partner institution.

The basic synthesis, in terms of frequency of responses per example, is as follows.

<p>1. I create a blog where I describe my experience on gardening and I accept comments by blog subscribers</p>	<table border="1"> <thead> <tr> <th>Response Level</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>9</td> </tr> <tr> <td>2</td> <td>3</td> </tr> <tr> <td>3</td> <td>1</td> </tr> <tr> <td>4</td> <td>0</td> </tr> </tbody> </table>	Response Level	Frequency	0	1	1	9	2	3	3	1	4	0
Response Level	Frequency												
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<p>2. I create a wiki of all the recipes that I have been learning to cook</p>	<table border="1"> <thead> <tr> <th>Response Level</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>9</td> </tr> <tr> <td>2</td> <td>2</td> </tr> <tr> <td>3</td> <td>2</td> </tr> <tr> <td>4</td> <td>0</td> </tr> </tbody> </table>	Response Level	Frequency	0	1	1	9	2	2	3	2	4	0
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<p>3. I create a YouTube channel where I publish the videos I have been recording of how I cooked my best dishes</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Frequency</th> </tr> </thead> <tbody> <tr><td>0</td><td>1</td></tr> <tr><td>1</td><td>9</td></tr> <tr><td>2</td><td>2</td></tr> <tr><td>3</td><td>2</td></tr> <tr><td>4</td><td>0</td></tr> </tbody> </table>	Category	Frequency	0	1	1	9	2	2	3	2	4	0
Category	Frequency												
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<p>4. I connect the temperature sensor of my oven to an Arduino board and then I create an app that alerts me on my smartphone when the temperature of the oven reaches a certain value</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Frequency</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>0</td></tr> <tr><td>3</td><td>5</td></tr> <tr><td>4</td><td>7</td></tr> </tbody> </table>	Category	Frequency	0	0	1	2	2	0	3	5	4	7
Category	Frequency												
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<p>5. I build a robot that is able to roll out dough by adapting its behaviour to the properties of the dough as they are sensed by the robot itself</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Frequency</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>1</td><td>3</td></tr> <tr><td>2</td><td>0</td></tr> <tr><td>3</td><td>4</td></tr> <tr><td>4</td><td>7</td></tr> </tbody> </table>	Category	Frequency	0	0	1	3	2	0	3	4	4	7
Category	Frequency												
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<p>6. Being interested in a special tool to roll out dough, I post a related question in a makers' website, and having found the appropriate drawing I download it and then I create the tool using a 3d printer</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Frequency</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>1</td><td>0</td></tr> <tr><td>2</td><td>1</td></tr> <tr><td>3</td><td>5</td></tr> <tr><td>4</td><td>8</td></tr> </tbody> </table>	Category	Frequency	0	0	1	0	2	1	3	5	4	8
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<p>7. By exploiting some open source libraries I write a software emulator of a device to roll out dough and I upload the source code on the website of an open source community</p>	<table border="1"> <thead> <tr> <th>Category</th> <th>Frequency</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>4</td></tr> <tr><td>3</td><td>4</td></tr> <tr><td>4</td><td>4</td></tr> </tbody> </table>	Category	Frequency	0	0	1	2	2	4	3	4	4	4
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<p>8. I take an existing digital device to roll out dough and I reprogram its firmware to obtain better performance of that tool</p>	
<p>9. I design a special tool to roll out dough by adapting a drawing I downloaded from the web, and then I create that tool using a 3d printer</p>	

For each of the nine examples the deviation of each response from the median and then the sum S (over the responses) of the absolute deviations have been computed:

Example	S
1	5
2	6
3	6
4	4
5	6
6	7
7	12
8	12
9	3

S is then an index of controversial interpretation of the example: the bigger the sum the more controversial the interpretation of the example among responders.

Hence there is an almost unanimous agreement on example 9 (“I design a special tool to roll out dough by adapting a drawing I downloaded from the web, and then I create that tool using a 3d printer”), as a case of DiDIY, and there is instead a significant disagreement whether examples 7 (“By exploiting some open source libraries I write a software emulator of a device to roll out dough and I upload the source code on the website of an open source community”) and 8 (“I take an existing digital device to roll out dough and I reprogram its firmware to obtain better performance of that tool”) are cases of DiDIY or not.

Furthermore, in the same poll it was asked:



<With the same lexical format of the previous examples, write at least one more situation, that you consider a relevant case of DiDIY, that it is significantly different than the situations listed above, and that should belong to the scope of the DiDIY project.>

The following situations have been proposed.

- I develop a web app that gathers data from most of the previous examples (Arduino, oven, robot, tool), plus a remote cam, so that I can check the whole process while I coming home and then I can cook directly.
- I regularly visit Instructables (<http://www.instructables.com>) because I like to learn about new making projects but also because I like to answer questions posed by others and to support other makers. I share my own projects, I adapt projects created by others, and I inspire people with my techniques and ideas, at Ravelry (<http://www.ravelry.com>).
- I 3D scan an existing object, I digitalize it, I modify its shape and usability and I 3D print it (incremental innovation).
- I 3D print an existing object (from open source libraries) and I add on-board intelligence (e.g., sensors) making it “smart”.
- I have just manufactured a new device with a lot of sensors and innovative functions to help athletes in testing their performances. I need to evaluate it and I print the cover for the electronic board in different shapes, colours and materials by a 3D printer to assess users satisfaction both on the information provided and on the look and feel of the new product.
- I have an idea for a new product that has a technology that I can not develop on my own. I enter in the community of “experts” and I do help to implement the software part. Finally I put our (because it’s not only mine now) finished product online available on the platform then the first step is: I have an idea but I need help to implement it the second step is: to go online and ask for help the third step is: I completed my product and I make it available to all. The philosophy is: to create a product that is improved with the contribution of all and then being available to all.
- A device is made available that, when given a book, reads out the words in it.
- I build an Arduino-based sensor for oven temperature tracking with a mobile app and install it for people in their kitchen.
- Using designs downloaded from the Web, I build hardware tools that, connected to a personal computer, can be driven by it to cut/drill/etc wood, metal, plastic and set up with them a community lab (sometimes called tool libraries) where everybody can book those tools for as many hours as needed, to build or repair furniture, car parts, toys, appliances, ...
- I am a teacher and, together with some colleagues, I make a web platform where we collect some tools for an new educational approach. It is a dynamic platform where other teachers, and people, can download materials and upload new tools and experiences.
- I download a digital description of a special cookie cutter, 3D print it, and use it to make cookies with my children.
- In a physics lab at high school, students have to measure the temperature of water in its transition from solid, to liquid to vapour. They create in advance a digital thermometer by Arduino and temperature sensor. I have to create tailored floating aids. I look in Internet for



suitable shapes and material, I tailor the design to the needed size and I produce the object by a 3D printer.

- My organisation, a bicycle manufacturer, installed sensors on the bicycles to monitor the degree of consumption of the tyres and anticipate the need of the clients with special offerings.
- My organisation, a washing machine manufacturer, collects big data from sensors installed on washing machines in order to redesign the product and make it more efficient.
- A group (a community?) of educators using Raspberry Pi discuss in a on-line forum the pros/cons of using it in K12 classes, and they come up quickly to a complete requirement analysis. Basing on this analysis, a new version of RP is developed.