# Women and Technologies: Towards a Gendered Profile of Digital Do-It-Yourself Workers?

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Abstract: Though yet partly unexplored, Digital Do-It-Yourself (DiDIY) is both an objective phenomenon that can be investigated from the point of view of its output and a subjective phenomenon that shapes individual behaviors and can be analyzed from the perspective of competences, motivations and social relationships. DiDIY is a complex socio-technical phenomenon that heavily impacts on organizations. Following recent research paths aimed at defining the subjective side of DiDIY, this research focuses on the gendered DiDIYer's profile. Female DiDIYers' personal characteristics seem to confirm previous studies dealing with the general DiDIYer's profile (Guerini and Minelli, 2018). They are digitally literate and aware of their skills, curious and eager to innovate. Proud and conscious of their potential contribution to the improvement of their lives and their workplace, open to professional and personal challenges, they qualify themselves as expert amateur, not just as pure technology adopters. Female DiDIYers are involved in organic and participative cultures and their roles are characterised by knowledge sharing and creation, also through communities of practice. Female DiDIY is concentrated in complex roles, which link the organization to the external environment, being intrinsically autonomous in their expression and far from clerical activities.

## 1 INTRODUCTION

Digital Do-It-Yourself (DiDIY) is an approach to carry out activities aimed at autonomously creating, modifying or maintaining objects and services. A DiDIYer is any individual adopting this approach by exploiting digital technology (DT) that reduce (or remove) the need of an expert to carry out such tasks (Mari, 2014). For example, a DiDIYer can be a worker in a manufacturing firm, carrying out prototyping activities without asking support of engineering firms, using 3D printers.

More broadly, the term DiDIY describes the phenomenon of the worldwide diffusion of such approach in the socio-economic environment. It stems from the convergence of multiple factors: the wide availability of digital tools, a general diffusion of a deeper knowledge and mastery of ICT among large portions of the population and a large accessibility of databases through open online communities (Digital DIY, 2017).

One can see DiDIY as an objective phenomenon, that can be investigated from the point of view of its output (e.g. tools, products or collaboration structures). At the same time it is a mindset (related to a culture of production and consumption), hence a subjective phenomenon that shapes individual behaviors and can be analyzed from the perspective of competences, motivations, social relationships. These two views of DiDIY are intertwined and mutually influencing. Thus, DiDIY as a complex "socio-technical" phenomenon has a heavy impact on organizations. Though yet partly unexplored, DiDIY is getting an increasing interest in the scientific literature. Some principles receive a large support and are exposed in relevant institutional websites (http://www.didiy.eu).

We build on such principles to investigate the DiDIY phenomenon where the DiDIYer is a woman. Gender implications related with IT adoption and use are not a new research subject (Wajcman, 2007; Roomi, 2009), but we are interested in investigating whether the diffusion of a DiDIY mindset can find a particularly effective domain amongst women.

In this paper we follow the research stream about the subjective side of DiDIY, focusing on the gendered DiDIYer's profile and investigating the characteristics that differentiate the female DiDIYer's profile from the ungendered one. In the next sections we review the literature related to DiDIY and to the

use of digital technology according to a gendered perspective. We then discuss the general implications of the DiDIY phenomenon on the organizational change. Based on this theoretical background, we introduce the empirical study and finally discuss the evidences collected from about 600 answers to a questionnaire, leading to a preliminary view of women's approach to digital technologies and DiDIY.

## 2 THE DiDIY PHENOMENON

The DiDIY phenomenon is the recent evolution of the broadly studied phenomenon of DIY, or Do-It-Yourself (Edwards, 2006). Several scholars in the past ten years have noted that the progress in digital technology has supported the development of autonomy in performing tasks of any type, as well as the rise of an "entrepreneurial" attitude in individuals with very different interests and background (Hoftijzer, 2009; Kuznetsov and Paulos, 2010).

More recently, the term "Maker" (Anderson, 2012) gained wide popularity as a label to characterize individuals, who, in addition to such mindset, exploit the interaction within communities of peers to accelerate the development of skills through a shared approach to problem-solving, supported by the use of social-networking platforms, such as blogs, wikis, and any other social media available (Buxmann and Hinz, 2013). However, "Makers" usually refers to communities of subjects involved in manufacturing activities. On the contrary, there is evidence that DiDIY, as a mindset and as an activity, can indeed take place within existing work-places belonging to any industry, e.g. in hospitals, in retail companies (Ravarini and Strada, 2018).

The research carried out in several organizational contexts led to isolate a set of properties characterizing the profile of a DiDIY worker: job attitude, autonomy, failure positive, multidisciplinary, playfulness, anti-consumerism behaviour, computational thinking (Cremona and Ravarini, 2016).

A scholarly work by Guerini and Minelli (Guerini and Minelli, 2018) researched these fundamental traits of a DiDIYer in the context of network marketing. This paper is focused on NMDSOs (Network Marketing Direct Selling Organizations) where the DiDIYers are networkers. Guerini and Minelli's exploratory study suggests a series of items to be considered in defining the subjective side of DiDIY, i.e. the DiDIYers' profile, that we outline in the following paragraphs.

The drivers that motivate networkers to behave as DiDIYers can be described as an internal force (curiosity, intention to take on a challenge, a desire to experiment creatively) or as a momentary thrill, thus qualifying this DiDIYer's mindset as passionate. The community vision largely overcomes the interest in individual benefits: the autonomy of direct salespeople and the existence of downlines (or communities of practice) encourage individuals to exploit unique competences and be the creator of the environment. Performance effects awareness and performance measurement are, on the contrary, neglected by networkers, though collaboration, cohesion and mutual reinforcement are important in network marketing culture, and DT is considered one of the means that guarantees all that through connectivity. On the other hand, it is the community appraisal of the individual role embedded in network marketing culture that feeds motivation and favours the adoption of a DiDIY-like mindset. Information technology is increasingly used by personnel engaged in network marketing activities also as a means to encourage collective action in support of the advancement of an ideology or idea (Oh et al., 2013). In this sense community-building, and action-oriented messages (Lovejoy and Saxton, 2012) seems to pertain to an 'ideology of sharing' in that network marketers consider this activity much more as a typical way of life rather than as an alternative distribution model for goods and services (Guerini and Minelli, 2016).

### 2.1 Gendered Technology

The joint consideration of gender and technology is at the heart of this research project. The central premise of feminist techno science is that people and artefacts co-evolve: the materiality of technology affords or inhibits particular gender/power relations, such as gender division of labour. It foregrounds the need to investigate the ways in which women's identities, needs and priorities are being reconfigured together with digital technologies also in relation to different groups and diverse real-world locations (Wajcman, 2007; Anwar et al., 2017). Despite women's massive consumption of new media, Internet and social networks do not transform every user into an active producer, and they do not include every woman into the network society. The potential for empowerment offered by ICTs can be realized through technical skills because gender imbalance in technical expertise turns out to be an important obstacle to full inclusion into the digital society and to enjoy the opportunities it opens up (Wajcman, 2007).

In the organisational context, the relationship between gender and technology is still complex (Eriksson-Zetterquist, 2007) because of women's vertical and horizontal segregation. Technology has been always associated to men since its diffusion after World War II. Moreover, women who try to escape glass ceiling phenomena through self-employment and entrepreneurship in the ICT sector face hindrances in the access to technological and social capital (Halford and Savage, 2010).

Recent studies focus on how technologies are associated with the crystallization of social relations of different kinds, which endure and foster the production and accumulation of practices and activities of various kinds (Halford and Savage, 2010) giving rise to "the particular knowledge/power relations that establish the hegemonic norms of gender … and technology in particular contexts" (Butler, 2004, p. 216).

These aspects couple with the issue of access to technological and social capital, which is critical to the development of technological businesses. In particular, the literature on women entrepreneurs stresses their lack of social capital as an impediment to expanding their businesses. Some scholars (Roomi, 2009) observe that the production of social capital is influenced by a strict gender labour-division.

In brief, even if the debate on the relation between technology and gender is lively, and the concerns about the inclusion of women in the technological context are steady, research in this domain doesn't focus attention on the role of those women that create, modify or maintain objects and services based on digital technologies, being a worker or, eventually, a customer and a co-creator.

## 2.2 The Research Questions

The study aims at investigating the characteristics of female DiDIYers, and in particular their personal traits, roles, goals and mindsets. The investigation of their work environment takes on a particular importance in shaping their mindset. Thus the research questions are:

- is there a female approach to digital technology and DiDIY?

- are there personal and organizational (i.e. workplace) characteristics that impact on women's attitude towards DiDIY?

- what is the female DiDIYers' profile and mindset?

# 3 SAMPLE, METHODOLOGY AND RESEARCH TOOLS

The study involved a sample of women working in the Municipality of Milan and its agencies, at LIUC University (a small University located in North Italy) or associated to a well-known female membership corporation (Valore D).

The Municipality of Milan is one of the largest local public administrations in Italy. It employs 14,478 employees (as of 31 December 2016), among them 64% are women and 5% work in its agencies. Nevertheless only 38% women cover managerial roles, revealing the persistence of a glass ceiling phenomenon. Its organizational structure is a modern bureaucracy involved in an important digital change process. The University is a non-state entity focused on the teaching of managerial disciplines. Administrative staff is predominantly composed of women (73,7%), while men prevail in the academic staff: among them just 30,2% are women. Valore D is the most relevant Italian Association whose mission is to promote women's leadership in the corporate world. It aims at increasing women's representation in top positions in major Italian companies through tangible and concrete actions. Their members are represented by about 150 large companies. It is significant that the Association's headquarters are at the premises of the Talent Garden, a global network of digital innovators.

For the purposes of the research the most effective tool of analysis was an on-line survey because it allowed the collection of a large amount of data overcoming time and distance problems.

The questionnaire developed for the on-line survey was organised in five thematic macro-areas concerning personal references, professional experience, digital literacy, attitudes towards digital technologies and approach to DiDIY.

Women were invited to participate in the survey by e-mail. Data collection took place from April to July 2017, and a large amount of responses was obtained. On the whole, the survey gathered 591 questionnaires; 492 filled in by women working in the public sector, specifically in the Municipality of Milan. Even if the sample is not statistically representative, it provides a meaningful picture of women's skills, attitudes and expectations towards digital technologies and DiDIY within the Municipality of Milan.

The results of the survey were analysed through quantitative methods.

Responses were statistically treated in different ways, according to their nature (i.e. numbers, categorical variables and ordinal variables).

# 4 DATA ANALYSIS

## 4.1 Profile and Mindset of the Sample

The sample comprises 591 Italian women, 83% working at the Municipality of Milan. On average, they are 49 years old, ranging from 25 to 64. The great majority of them (69%) was born in Lombardy. Their education level is highly differentiated: 44% of the sample has a university degree (44%), 37% a technical diploma, 12% a high school diploma. Besides, some of them (14%) declare to participate actively in some associations.

The job roles are diversified, both the function and the hierarchical level. Among the most frequent positions, 58% are employed in administrative roles, 16% in Human Resource Management and 13% in Operations. Most of them (69%) work in a large organization (more than 250 employees and 50 million turnover), which implies that they use to work in a complex environment. Moreover, women comprised in the sample generally work in team (78%) and refer to a community of practice (35%).

Notwithstanding the complexity of the work environment, their job context is mainly characterised by informal coordination mechanisms. In particular informal communication prevails (84%), followed by the definition of the objectives to be achieved (42%).

On average the respondents rate their digital skills 2.8 out of 5, with 3 as median value. On the whole they perceive themselves as moderately expert.

Most respondents acquired their digital skills through field experience (56%), 21% are self-taught, and only 13% had digital training. Thus they are mainly self-motivated in developing their digital skills. Hobbies and games are the main fields of application of digital skills (18%), followed by professional use of social media to coordinate collaborators (8%) and marketing purposes (4%). It is interesting to notice that not only women that apply their digital competences for professional purposes (use of social media in management, website building, development of applications), but also those who apply their digital skills for game purposes reveal higher digital skills than average (3.2 out of 5). Also in this female sample gamification plays an important function in motivating people to acquire digital skills (Hamari and Koivisto, 2015).

Women's approach to digital technologies is strongly characterised by assiduity, curiosity, awareness, trust and reliance, whereas fear and constraint are weaker. A factor analysis was carried out and revealed a two-component solution (60% total variance explained, Varimax rotation). The components represent two opposing attitudes towards digital technologies, namely positive and negative attitudes (table 1).

Table 1: Rotated component matrix of attitudes towards digital technologies.

|  | Component | |
|---|---|---|
|  | positive | negative |
| Pleasure | 0.872 | |
| Passion | 0.866 | |
| Curiosity | 0.835 | |
| Assiduity | 0.78 | |
| Innovativeness | 0.769 | |
| Familiarity | 0.768 | |
| Awareness | 0.752 | |
| Reliance | 0.648 | |
| Constraint | | 0.751 |
| Fear | | 0.699 |
| Adjustment | | 0.676 |

Then a regression analysis was carried out where the dependent variables were the scores in the two attitudes (positive and negative), and the predicting variables included the age of the respondents, their perceived level of digital skills and the size of the organization they work in, considered an indicator of organizational complexity. The results of the regression analysis show that the perceived level of digital skills is a predictor of a positive attitude, whereas employee's age and organizational complexity are not significant (table 2).

Table 2: Regression coefficients for the positive attitude towards digital technologies.

|  | Coefficients[a] | | | | |
|---|---|---|---|---|---|
|  | Unstand. Coeff | | Stand. Coeff. | t | Sig. |
|  | B | Std. Error | Beta | | |
| Constant | 2.196 | 0.307 | | 7.144 | 0.000 |
| age | -0.007 | 0.004 | -0.071 | -1.680 | 0.094 |
| digital skills | 0.497 | 0.036 | 0.556 | 13.890 | 0.000 |
| org. size | 0.035 | 0.087 | 0.017 | 0.402 | 0.688 |

a. Dependent Variable: positive attitude

Following the results, organizations can pave the way for digital transformation through employees' digital skill reinforcement, almost regardless of the average age of staff. This is quite important, considering the need of organizations and public administrations to successfully manage digital change and the issue of workforce ageing.

Moreover, the fear of making mistakes does not hinder the search for innovative solutions through digital technology: fear seems to boost innovativeness along with curiosity, especially among DiDIYers, signalling that digital experimentation cannot be without fear of making mistakes but it is supported by digital skills.

The applications most used for any purpose by women are in order of importance WhatsApp, Excel and Facebook. These applications are preferred because of their expected benefits in terms of efficiency (time saving and cost reduction) and effectiveness (readiness and quality of results)

In any case, both in work and in social life, vis-à-vis (traditional) relationships are preferred to computer-mediated relationships (table 3). Human contact remains a key component of effective workplace relationships (Guerini and Minelli, 2018).

Table 3: Type of relationships preferred by women.

| Context | Type of relationships | | St.dev. |
| --- | --- | --- | --- |
| | vis-à-vis | digital technologies | |
| work | 55.5% | 44.5% | 19.9 |
| social life | 71.1% | 28.9% | 18.5 |

Women in the sample were also asked to indicate their level of agreement (on a scale 1 to 4) to different do-it-yourself (DIY) definitions. DIY is mostly perceived as a "satisfaction" (3.7 out of 4), able to develop skills and independence (3.3 out of 4), while there is a low level of agreement (<1.6) on statements defining DIY as "stuff for nerds", "boring" or a "waste of time". The factor analysis carried out on the results revealed a two-component solution (50% total variance explained, Varimax rotation). The two components are respectively usefulness and personal and professional development (table4).

This result highlights how women perceive DIY as a useful practice, able to develop personal aspirations and professional skills.

Also for DiDIY women were asked to express their level of agreement to some propositions defining

Table 4: Rotated component matrix of DIY perceptions.

| | Component | |
| --- | --- | --- |
| | usefulness | develop-ment |
| saves money | 0.757 | |
| reduces waste | 0.745 | |
| useful to find a job | 0.633 | |
| combines technology and art | 0.554 | |
| a hobby | 0.535 | |
| reassuring | 0.478 | |
| a satisfaction | | 0.762 |
| develops skills | | 0.727 |
| helps to become autonomous | | 0.691 |
| realizes one's own aspirations | | 0.551 |

this phenomenon. Women in the sample agree on DiDIY as a fundamental tool for work, which demonstrates an active use of technology (3.2 out of 4). Not only the respondents perceive the importance of technology for their jobs but also, more generally, "for the world". DiDIY thus becomes an almost salvific tool. In this case, all statements depreciating DiDIY were rated lower that those supporting it.

## 4.2 DiDIYers' Profile and Mindset

Among the respondents, a group of 38 women stands out: those women have developed new digital applications and in 32 cases they have realized them too. Those female DiDIYers that are at the core of this study. Slightly younger than the whole sample (48 years old), most DiDIYers were born in Lombardy (58%) and as many as 60% have a degree or a higher education level. The large majority (71%) is employed in the Municipality of Milan, they use to work in team (82%) and quite frequently refer to a community of practice in their professional activity (39%). Female DiDIYers perceive themselves as experts (3.6 out of 5).

Comparing them with the whole sample, a higher percentage of DiDIYers had specific training in digital skills (21%), whereas 42% acquired their skills thanks to field experience or is self-taught (18%). Nonetheless, similarly to the whole sample, the most part of them (60%) are self-motivated in developing their digital skills, even at a higher level of skill. However, in this DiDIYers' sample the main purpose of digital skills application is professional use (39%), followed by apps development (26%) and website

building (16%) whereas hobbies and games represent only a marginal purpose.

Among DiDIYers, 16% is employed in the Information Technology function and 18% in the Marketing and Customer Care functions. That reveals a first interesting result regarding the concentration of DiDIYers: DiDIYers are not uniformly present in all functions. The areas where women DiDIYers are mostly present are those related to technology (information technology and research & development) or strictly connected to the external environment (customer service and marketing). This outcome suggests that some kinds of activities stimulate and require a DiDIY attitude, in particular those connecting the organization with its environment.

Depicting their approach to digital technologies in their work and personal lives, women DiDIYers evaluated awareness, curiosity and innovativeness higher than the other items and feelings proposed and higher than the scores of the whole sample as well. This shows that awareness is an important indicator of digital literacy and that - together with curiosity and innovativeness - it represents a driver of expertise and a motivator of digital improvement (Gallardo-Echenique et al., 2015).

Moreover, passion and pleasure (respectively 3.7 and 3.6 out of 5) demonstrate that women DiDIYers are not only technology adopters but above all expert amateurs (Kuznetsov and Paulos, 2010). The factor analysis carried out revealed a two-component solution (68% total variance explained, Varimax rotation). The components are represented in this case by the meanings that the digital technologies take on for female DiDIYers, namely innovation and reliability (table 5). Thus, in this case the components are not represented by dichotomic perception (positive and negative) of the value of digital technologies as for the whole sample, but by a deeper awareness of the impact of digital technologies on their lives.

Notwithstanding their digital skills, women DiDIYers' propensity to vis-à-vis relationships is similar to the whole sample both in work and social life, pointing out that the human touch is predominant in social life and cannot be replaced by virtual relations (table 6).

Table 6: Type of relationships preferred by women.

| Context | Type of relationships | | St.dev. |
| | vis-à-vis | digital technologies | |
| --- | --- | --- | --- |
| work | 55.8% | 44.2% | 21.0 |
| social life | 69.0% | 31.0% | 20.5 |

Most of them used software for the creation and management of websites and blogs or for the realization of digital videos; some also used 3D printers and scanners, and a few made use of electronic prototyping cards (such as Arduino, RaspberryPi, etc.). In general, female DiDIYers think that there is still a lot to do in the field of digital applications for professional use (89%), in particular for relational and technical purposes. In fact, 26% of them developed, and in some cases even realised applications devoted to the improvement of coordination and collaboration, for control purposes (26%), to improve efficiency (26%) and 11% to improve effectiveness.

In their digital activities they are not motivated just by curiosity or game: women DiDIYers are pushed also by innovation, personal intuition and experimentation (26%) and, above all, by professional challenges (60%). Therefore, in this sample women reveal that as their digital literacy grows, they are less motivated by ludic aims and increasingly by innovation purposes and professional challenges.

## 5 CONCLUSIONS

The study investigates women's approach to digital technologies and DiDIY, outlining personal and organizational characteristics that impact on women's attitude towards DiDIY.

The sample includes 591 female respondents; a part of them can be defined as DiDIYer because they declare to have developed and, partly, realized new digital applications. Women in the sample are mature and educated and, among the DiDIYers, as many as 60% have a degree or a higher education level.

Table 5: Rotated component matrix of women DiDIYers' attitudes towards digital technologies.

| | Component | |
| | innovation | reliability |
| --- | --- | --- |
| Innovativeness | 0.863 | |
| Curiosity | 0.851 | |
| Passion | 0.825 | |
| Pleasure | 0.795 | |
| Familiarity | 0.507 | |
| Assiduity | | 0.881 |
| Awareness | | 0.753 |
| Adjustment | | 0.736 |
| Reliance | | 0.600 |

The sample comprises mostly women working in large organizations in various roles. Their organizations are characterised by complexity, though informal coordination mechanisms based on direct communication are widespread and overlap to almost all other mechanisms (rules, procedures, objectives etc.). Thus, complexity does not necessarily combine with high formalization; on the contrary, there is room for direct communication and human contact. Moreover, women mostly work in teams and some of them refer to a community of practice in her job, underlying the importance of professional links, both within and outside the organization. This trait is amplified among the female DiDIYer, concentrated in a few organizational areas, and in particular in those functions that connect the organization to the external environment, such as Research and Development, Marketing and Customer Service. Thus, organizational complexity and connections with the external environment are the emerging characteristics of the female DiDIYers' workplace. Knowledge sharing and creation within organic and participative cultures, also through communities of practice, are also important features.

In the sample women perceive themselves, on average, as moderately expert, whereas the DiDIYers rate their digital expertise as higher, even if all declare to have acquired their digital skills mainly through field experience and self-training. Therefore, self-motivation appears to be an important driving force in developing digital skills. It's interesting to notice that not only women that are engaged in technological activities, but also those who apply these abilities for recreational goals declare a higher level of digital expertise than average, showing that gamification plays an important role in acquiring digital skills and that it can be a successful tool in training people in large organizational contexts. However when it comes to DiDIY activities, game is no longer a driver: female DiDIYers are pushed also by innovation, personal intuition and experimentation and, above all, by professional challenges. Therefore this study suggests that gamification can play an important role in approaching digital technologies and training basic digital skills, but at a higher level of competences gives way to other levers, in particular to the appeal of innovation and personal and professional challenges.

Women in the sample consider digital technologies as an almost salvific tool. In more details, female DiDIYers describe their attitude towards digital technologies with the concepts of awareness, curiosity and innovativeness, confirming that the awareness of being a digital expert is a fundamental trait of DiDIYers. Moreover, passion and pleasure demonstrate that women DiDIYers are not only technology adopters but above all expert *amateur* (Kuznetsov and Paulos, 2010).

In more details, the regression analysis highlights that the perceived level of digital skills is a predictor of a positive attitude towards digital technologies whereas staff's age and organizational complexity aren't. This result shows that organizations - and public administration as well - can favour digital transformation through their employees' digital skills training and manage a successful transition even within a context of workforce ageing. In any case, so far, personal and traditional relationships are preferred to virtual computer-mediated ones, even among DiDIYers. In this sense the human contact is probably an irreplaceable component of wellbeing, both in the workplace and in social life and no substitution effects of digital technologies on human relationships is accepted or expected.

Finally, female DiDIYers' mindset is that of passionate people, emotionally involved, educated and aware of the high value of DiDIY outputs. At the same time, they are proud and conscious of their potential contribution to the improvement of their lives and their workplace. In their opinion the developing technology feeds on creative experimentation and becomes almost a vision of the world.

This study aims at advancing the knowledge of the DiDIY phenomenon in the gender domain. However, it has several limitations They include issues related to: (a) sampling, (b) participants' level of honesty and accuracy; (c) the study was also limited to one country (Italy) and (d) mainly big public corporations. Nonetheless, the study contributes to shedding some light on the relation women-technologies and, moreover, on the existence and the actual characteristics of female DiDIYers in complex organisation.

The results acknowledge some distinctions between female workers and female DiDIYers, outlining the emerging characteristics of the female DiDIYers' profile. Nevertheless, our research does not outline gender-related differences. Further research comparing men and women working within the same organizations could outline those differences. The study suggest that DiDIY might have a direct impact on firms' performance. A deeper knowledge of the phenomenon within the functional areas where it is concentrated would enable insight (Anwar, et al., 2017; McDonald, 2017) on how organizations can engage female employees in DiDIY to improve performance and workers' satisfaction.

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