1. Italy

By Rossella Bozzon, Annalisa Murgia, Barbara Poggio

1. INTRODUCTION

It is not easy to get a complete picture on career trajectories as well as on gender inequalities that characterize (early stages of) scientific careers in Italy. Available data are incomplete; they focus mainly on employment conditions and/or on specific cohorts of graduation, or institutions, or scientific disciplines; and, hence, they not allow to monitoring the career trajectories in scientific careers over time.

At the national level, the main data sources are the Italian Ministry of Education, University and Research (Ministero dell'Istruzione, dell'Università e della Ricerca (Miur) database and the Italian National Statistcs Office (Istat, www.istat.it) survey of PhD holders.

The Italian Miur (http://www.istruzione.it/) publishes every year data on the composition of the academic staff (full professors, associate professors and assistant professors), as well as on fixed-term research and teaching contracts (fixed terms researchers, post doc research fellows) and PhD and graduate students. These data allow to monitor the structure and some career transitions only within the academic system. However, they do not allow to analyse the complexity and the growing instability that characterize the initial phases of scientific careers; nor do they allow to explore adequately the interrelation between individuals' career and private life, let alone career paths outside the academic system.

Some information about the early stages of scientific careers trajectories within and outside academia can be derived from two national surveys on "Doctorate Holders' Vocational Integration", carried out by Istat in 2009 and 2014. These surveys aim to detect the employment conditions of PhD holders some years after their graduation. The first survey interviewed the 2004 and 2006 cohorts of PhD graduates respectively 5 and 3 years after graduation, while the second interviewed the 2008 and 2010 cohorts of PhD graduates after 6 and 4 years after graduation. The surveys gather information about the educational experience; access to the labour market; experiences of mobility, especially towards other countries; and (few information about) family situation[1].

Finally, other information can be derived by research reports and analyses based on surveys conducted by some Italian Universities (Schizzerotto 2007; Argentin et al, 2012), scientific associations (Corsi 2014) and research projects (UPGEM 2008, Ricercarsi 2014; Stages 2014[2]), with the main aim of obtaining sets of information that are missing from official data released by Miur and Istat.

[1] Dataset on the first survey is available on the Istat website www.istat.it while for the second survey at this stage only a brief summary of main results is available (Istat 2015a; 2015b).
[2] http://www.stages.unimi.it/index.php

At the University of Trento, the data and the indicators on academic staff are mainly managed by the University Statistical Office (Ufficio Studi). Since 2009, the Equal Opportunity Commissions (CPOs) has published indicators on the gender compositions of the University community at all levels. Thus, some information on gender asymmetries among students and academic staff are available in the reports on university research and teaching activities produced by the University Evaluation Group. Finally, two ad hoc surveys were conducted in 2006 (Schizzerotto 2007) and 2010 on PhD graduates in order to monitor their career trajectories and to obtain some information of their PhD experience.

2. MAPPING THE INDICATORS AT THE NATIONAL LEVEL

Over the last ten years, four main dynamics have come to characterize the Italian academic system and thus have significantly re-drawn overall chances of pursuing a scientific career:

1. The steady increase in the number of PhD-holders, which has almost tripled between 1998 and 2013 (Fig 1).
2. The flexibilisation/precarization of the early-stages research positions introduced in 2005 by the Moratti reform (Law n. 230/2005) and completed in 2010 by the Gelmini reform (Law n. 240/2010). The main changes related to academic careers concern the abolishment of permanent assistant professors positions and the subsequent introduction of fixed term research positions (for more details see Bozzon et al. 2015; Rapetti et al. 2015; Peroni et al. 2015).
3. The substantial modification of recruitment and promotion procedures, in order to limit collusive behaviour as well as to increase competition within the academic system[3]. The recruitment procedure was reorganized and partially (re)centralized in 2010 through the introduction of a 'national scientific qualification' (NSQ)[4] as a mandatory prerequisite to access permanent positions (associate and full professorships)[5]. Moreover, as the Gelmini reform stresses the importance of 'merit evaluation', selection processes have witnessed a significant increase in the use of bibliometric indicators and other quantitative measures of academic performance.
4. The increasing level of restrictions imposed to the University system in order to reduce public expenditure. More in particular, since 2009 the academic staff turnover has been limited by law (at a threshold of 50% on the ceasing staff for the recent years) (Donina et al. 2014: 7). Moreover, in conjunction with the economic crisis, severe cuts to University public funding have been set by law (-18.7% between 2008 and 2013). Such budget restrictions have in fact been imposed in an overall context where the national

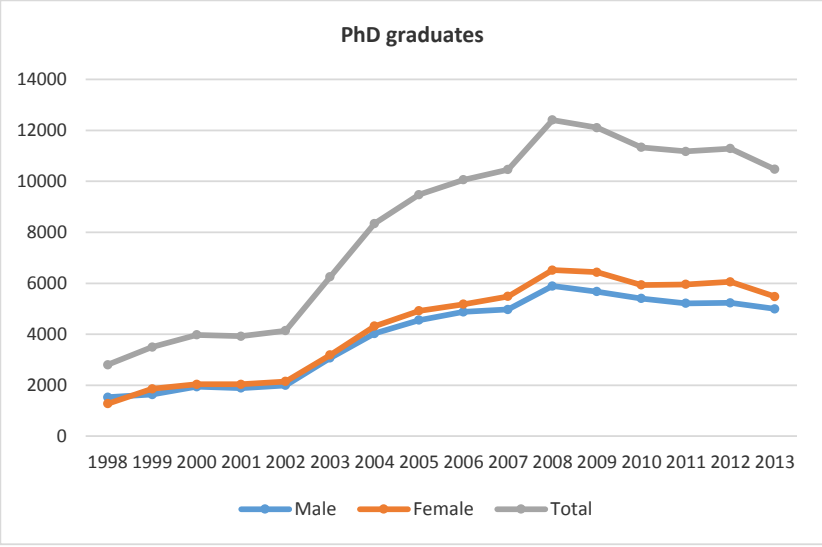
[3] The Italian university system is regulated by national laws and by local statutes. Recruitment procedures, employment conditions and salaries fall under the control of nation-wide norms.

[4] In Italian: Abilitazione Scientifica Nazionale (ASN).

[5] With the current rules, to move up to a professorship position, a researcher needs first to get what is called *idoneità* (i.e. a scientific qualification); that is, he/she has to apply for a national competition in order to be acknowledged as 'idoneo' (employable, or fit for service) by a national committee within a specific "research field" (settore disciplinare). Once the national committee has provided the list of 'candidati idonei', those candidates can proceed to the second step and apply for a position at a local university, within a period of four years. If the candidate does not get a position within this period, s/he must apply again for the 'idoneità'. Candidates who do not pass the national competition have to wait for two years to re-apply.

research and development expenditure is considerably lower than the OECD average, and has remained steady between 2001 and 2011 (Oecd 2013; Martucci 2011).

Figure 1 – PHD graduates in Italy – 1998-2013



Source: MIUR "Indagine sull'Istruzione Universitaria", May 2015 - http://statistica.miur.it/scripts/postlaurea/vpostlaurea.asp

The current composition of the academic staff reflects the consequences of these dynamics. Table 1 shows the distributions of men and women in a typical academic career in Italy in three different moments: in 2003, before the abovementioned reforms; in 2008, during the legislative reform process; and in 2013, three years after the introduction of the Gelmini reform. The table shows the involvement of men and women in each position and, for each position, its level of feminization.

Between 2008 and 2013, a consistent decrease in the number of the Italian permanent academic staff occurred - from 62768 to 53446 employees (-14.9%) - mainly due to the massive retirement of part of the permanent academic staff (full, associate, and assistant professors) recruited in the first part of the Eighties. Such decrease went hand in hand with a steadily increase of the new non-permanent positions, post-doc research fellows, and fixed term researchers. In 2013 temporary positions accounted for 29% of the total research staff (academic staff plus postdoc research fellows) while their incidence was around 22% in 2008.

The proportion of temporary research positions grows up to 93.2% for researchers aged less than 35 and up to 51.8% for the age class 35-39 (Table 2). Women shows higher level of job instability: for women aged 35-39 the share of temporary positon is 55.8% while for men aged 35-39 this share is 48.4%.

Despite these substantial changes in the composition of the Italian research staff, the *gender gap* among the various academic positions seems to remain stable over time. Because the outgoing flows from the academic system - mainly due to retirements- have not been not compensated by a virtuous recruitment and promotion process, small improvements have been made on re-balancing the proportion of men and women at the top of the academic hierarchy (*vertical segregation*). While women in 2003 were only 15.9% among full professors and 31% among associate professors, in 2013 they were respectively 21.1% and 35% (Table 1). These changes correspond to the ones documented at the European level in *She Figures 2012* (EU, 2013: 88).

Frattini and Rossi (2011) documented that the disadvantage (understood as transition rate) of Italian female academic staff in career advancements has not changed between 2000 to 2011 – both for the transition to associate professorship and to full professorship (Frattini and Rossi, 2012). Lower chances in career advancement are documented also for women in physics (Lissoni et al. 2011), in the field of economics (Corsi 2014), and for employees of the CNR (National Research Council) (Palomba 2000; Menniti and Cappellaro 2000).

The structure of the Italian academic hierarchy maintains a scissor pattern. According to the data, female students outnumber male ones; the proportion of women and man is quite balanced among PhD students, PhD graduates, and post-doc research fellows. However, the transition into the academic career corresponds to a typical drop of female presence in assistant professor positions: only 45.6% among permanent assistant professors are female and 43.1% among fixed term assistant professors (these latter are mainly the researchers hired after the introduction of the Gelmini reform).

This scissor pattern varies substantially across fields of study (Table 2) (*horizontal segregation*). Women are still strongly under-represented in all academic positions in engineering and technology and thus draw a "*non-scissor pattern*" (Badaloni et al., 2011). In the natural sciences, the gap is still relevant among senior positions, but is significantly reduced among PhD students and postdocs[6]. Recently, the access to and the participation of women in STEM has been addressed by several initiatives. The number of women who take up a career in the scientific sector has remarkably increased in the past 25 years, and there is a positive evolution in the number of female students and graduates in STEM. However, the gender gap remains over the career evolution and reaches particularly striking levels when considering top positions.

The pictures for the SSH disciplines is quite different in terms of gender balance. Within humanities, males are over-represented only among full professors, while females weight more than males in the distribution of the early stages positions.

This trend does not exclude the presence of a leaky pipeline if we take into account that, among graduate students, females are more than 80% in this field (OECD, 2014) and their proportion drops by 20 percentage points among PhD graduates. This means that male graduated in this field are more frequently involved in the PhD courses than women.

In the social sciences, the distribution of male and female appears quite balanced among PhD graduates and post-doc research fellows but the scissor blades are particularly open

[6] The classification adopted in this report (Canberra classification adopted by Oecd) partially hides the heterogeneity among the various areas within the natural sciences group. While women are strongly under-represented in Mathematics and Physics describing a pattern closer to the Engineering field, in Biology and Chemistry the gap between men and women is almost nullified among students and in the earlier research positions.

when considering the top positions. This pattern has remained almost stable over the last ten years. A recent report on the status of the members of the Italian Economic Association (SIE) (Corsi 2014) shows that for women in this disciplines the persistence role in lower bands (assistant professor positions) seems to be more frequent. In the same way, career advancements are slower and more difficult, whereas male career trajectories seem to be faster and linear (Corsi and Zacchia 2014).[7]

As largely documented (Badaloni et al. 2011; EU 2013; Lasconi et al, 2011; Ajello et al. 2008), one of the main bottlenecks for women within universities is situated between the end of the PhD and early career stages.

The significant growth in the numbers of the PhD holders occurred over the last 20 years has increased the level of competition during the early stages of scientific careers (Fig 1). The increase in the numbers of PhD graduates characterizes all fields of study, although the SSH disciplines – which have a weaker link with the labour market - show even a sharper growth (Argentin et al. 2012).

In this regard, the main critical aspect is that in Italy the number of PhD holders has increased more than the demand of PhD holders. Thus, such growth has been accompanied by a reduction of chances to pursuit a career within the Italian academic system. Observers estimated that in the decade 2004-2013, only 6.7% of researchers with a temporary position actually succeeded in obtaining a permanent position in academia (Toscano et al. 2014). Conversely, the diminished capability of the Italian academic system to absorb all these resources has been compensated only partially by an increased chance to obtain a research position outside academia (Martucci 2011; Ballarino Colombo 2010). Indeed, in Italy a PhD degree is not appreciated outside academia and it does not entail any added value to facilitate the access other positions both in the public and in the private sector (Bonatesta et al. 2014; Kehm 2007).

The opportunities to find more qualified and better-paid positions are the main reasons that motivate Italian PhD holders to leave Italy (Istat 2015b). Data confirm that among the PhD holders moving abroad, 68% are employed in universities and research centres, while this proportion drops by 27 percentage points among PhD holders who live in Italy (40.9%) (Istat 2015a). Women are less likely to move abroad than men and personal as well as family issues are the main reasons that prevent international mobility (MORE2 2013).

[7] The report also shows that the investment of women in the profession (in terms of education, organizational activities and research) is significant, equivalent to, if not higher than that of men. However, women face difficulties in career advancement. In particular, women do not succeed especially when cooptation is at work and some professional skills are acknowledged. Women (especially the younger cohorts) do research, but they are less visible and less involved in professional networking. Moreover, about 43% of the women in the sample survey acknowledge to have suffered from some form of discrimination (but only 18% among men), and 67% of cases are related to the mere fact of being a woman. On a personal level, the data show that for a significant number of women there is a trade-off between family and work: a large share of female economists in Italy do not live with a partner and do not have children (Corsi 2014b).

Table 1 – Proportions of men and women in a typical academic career, 2003, 2008 2013

	2003				2008				2013			
	M	F	TOT	F/TOT%	M	F	TOT	F/TOT%	M	F	TOT	F/TOT%
Academic staff (a+b+c+d):	*39109*	*17371*	*56480*	*30.8*	*41812*	*21524*	*63336*	*34.0*	*35954*	*20654*	*56608*	*36.5*
Permanent positions												
Full professor (a)	15095	2862	17957	15.9	15364	3565	18929	18.8	10955	2935	13890	21.1
Associate professor (b)	12459	5638	18097	31.2	12080	6176	18256	33.8	10278	5532	15810	35.0
Assistant professor (c)	11555	8871	20426	43.4	14044	11539	25583	45.1	12923	10823	23746	45.6
Temporary positions												
Fixed-term researchers (d)	-	-	-	-	324	244	568	43.0	1798	1364	3162	43.1
Research staff												
Post-doc research fellows	4857	5400	10257	52.6	5712	6097	11809	51.6	9592	10107	19699	51.3
Research collaborators involved in research activities (1)	3653	3224	6877	46.9	2692	3053	5745	53.1	4222	3946	8168	48.3
PhD graduates	3066	3183	6249	50.9	5894	6514	12408	52.5	4994	5480	10474	52.3
PhD students	14372	15078	29450	51.2	17830	19890	37720	52.7	16281	17614	33895	52.0
MA/BA Students	779324	988971	1768295	55.9	780567	1028932	1809499	56.9	737318	972090	1709408	56.9

Source: our elaborations on Miur data ("Banca dati dei docenti di ruolo" and "Banca Dati del Personale Docente a Contratto e Tecnico Amministrativo"), May 2015, http://statistica.miur.it/

Note: (1) research collaborators are not considered part of the research staff.

Tab 2 – Distribution of research staff (Academic staff and postdocs) by age class. Italy 2013

	Total								
	min/34	35-39	40-44	45-49	50-54	55-59	60-64	>=65	Total
Full prof.	0.0	0.2	2.6	11.6	23.6	34.7	45.6	69.6	19.1
Associate prof.	0.1	3.3	16.7	33.3	40.1	34.5	30.5	28.5	21.8
Assistant prof.	6.5	44.5	60.2	49.0	34.2	29.8	23.5	1.5	32.7
Fixed term assistant prof.	7.0	12.0	5.8	2.0	0.7	0.2	0.1	0.1	4.0
Postdocs	86.5	40.0	14.8	4.1	1.4	0.7	0.2	0.3	22.4
Total	100	100	100	100	100	100	100	100	100
	Women								
	30-34	35-39	40-44	45-49	50-54	55-59	60-64	>=65	Total
Full prof.	0.0	0.0	1.2	5.5	13.2	23.6	32.9	59.7	10.2
Associate prof.	0.0	1.8	13.2	29.5	39.2	36.2	34.2	38.5	19.2
Assistant prof.	5.6	41.9	61.9	57.1	44.4	38.7	32.0	1.4	37.6
Fixed term assistant prof.	6.0	11.6	5.6	2.2	0.9	0.3	0.4	0.1	4.4
Postdocs	88.3	44.6	18.0	5.7	2.3	1.1	0.5	0.4	28.5
Total	100	100	100	100	100	100	100	100	100
	Men								
	30-34	35-39	40-44	45-49	50-54	55-59	60-64	>=65	Total
Full prof.	0.0	0.4	3.7	15.8	29.4	40.3	51.9	72.3	24.9
Associate prof.	0.1	4.5	19.6	35.9	40.6	33.6	28.5	25.8	23.4
Assistant prof.	7.3	46.7	58.7	43.4	28.5	25.3	19.2	1.5	29.4
Fixed term assistant prof.	7.9	12.3	5.9	1.8	0.6	0.2	0.1	0.1	3.7
Postdocs	84.8	36.1	12.1	3.1	1.0	0.5	0.2	0.3	18.4
Total	100	100	100	100	100	100	100	100	100

Source: our elaborations on Miur data, February 2015.

Table3 – Proportions of men and women in a typical academic career by fields of study, 2003, 2008 2013

	2003				2008				2013			
	M	F	Tot	F/Tot*100	M	F	Tot	F/Tot*100	M	F	Tot	F/Tot*100
Natural sciences												
full prof.	4466	765	5231	14.6	3814	846	4660	18.2	2514	694	3208	21.6
Associate	3830	1852	5682	32.6	3124	1839	4963	37.1	2505	1576	4081	38.6
Assistant	2652	2354	5006	47.0	3110	3160	6270	50.4	3046	3051	6097	50.0
Fixed term researchers									371	304	675	45.0
Post-doc	na	na	na		1612	1744	2151	42.8	2351	2448	4799	51.0
PhD graduates	829	993	1822	54.5	1283	1438	2721	52.8	1191	1268	2459	51.6
Medical science												
full prof.	2237	218	2455	8.9	2287	297	2584	11.5	1657	261	1918	13.6
Associate	2554	655	3209	20.4	2529	768	3297	23.3	2022	669	2691	24.9
Assistant	3117	1607	4724	34.0	3352	2032	5384	37.7	2723	1879	4602	40.8
Fixed term researchers									206	171	377	45.4
Post-doc					451	1198	1649	72.7	649	1669	2318	72.0
PhD graduates	329	523	852	61.4	775	1282	2057	62.3	600	1064	1664	63.9
Engineering/architecture												
Full prof.	1989	159	2148	7.4	2708	255	2963	8.6	2045	237	2282	10.4
Associate	1706	305	2011	15.2	2218	476	2694	17.7	2014	496	2510	19.8
Assistant	1321	475	1796	26.4	2568	976	3544	27.5	2418	965	3383	28.5
Fixed term researchers									384	161	545	29.5
Post-doc					1964	894	2858	31.3	3107	1462	4569	32.0
PhD graduates	809	369	1178	31.3	1448	739	2187	33.8	1329	719	2048	35.1
Agricultural science & Veterinary												
Full prof.	889	105	994	10.6	864	138	1002	13.8	607	112	719	15.6
Associate	651	246	897	27.4	626	313	939	33.3	543	317	860	36.9
Assistant	561	430	991	43.4	716	609	1325	46.0	680	617	1297	47.6
Fixed term researchers									67	62	129	48.1
Post-doc					362	434	796	54.5	504	677	1181	57.3
PhD graduates	174	207	381	54.3	333	339	672	50.4	309	331	640	51.7
Social sciences												
Full prof.	2987	523	3510	14.9	3396	782	4178	18.7	2604	709	3313	21.4

Associate	1817	823	2640	31.2	1956	1065	3021	35.3	1817	1058	2875	36.8
Assistant	1533	1201	2734	43.9	2451	2131	4582	46.5	2328	2035	4363	46.6
Fixed term researchers									385	284	669	42.5
Post-doc					832	870	1702	51.1	811	940	1751	53.7
PhD graduates	552	523	1075	48.7	899	1048	1947	53.8	805	891	1696	52.5
Humanities												
Full prof.	2177	999	3176	31.5	2295	1247	3542	35.2	1528	922	2450	37.6
Associate	1591	1556	3147	49.4	1627	1715	3342	51.3	1377	1416	2793	50.7
Assistant	1256	1911	3167	60.3	1847	2631	4478	58.8	1728	2276	4004	56.8
Fixed term researchers									235	293	528	55.5
Post-doc					560	891	1451	61.4	649	960	1609	59.7
PhD graduates	373	566	939	60.3	708	1080	1788	60.4	697	1116	1813	61.6

Source: our elaborations on Miur data ("Banca dati dei docenti di ruolo" and "Banca Dati del Personale Docente a Contratto e Tecnico Amministrativo"), May 2015, http://statistica.miur.it/

Recent data on doctorate holders' vocational integration (Istat 2015a; 2010) show that PhD holders do not face serious risks to remain outside of the labour market, when compared to other level of education[8]. Employment is particularly high among doctorate holders in mathematics and computer sciences, industrial and information engineering (more than 97% for the 2008 doctorate holders and more than 95% for the 2010's ones). Conversely, historical, philosophical, pedagogical and psychological sciences doctorate holders have a lower percentage of employed (around 88 percent) (Istat 2015a). Between 2009 and 2014 there has been a growth of PhD holders working abroad: in 2009, only 7% of the PhD graduates belonging to 2004 and 2006 cohorts were working in another country, but in 2014 this was the case for 12.9% of the PhD graduates in 2008 and 2010.

Argentin et al. (2014) examined possible advantages deriving from the achievement of a PhD position in terms of quality of employment conditions show that PhD holders seem to have lower risks of being employed in underqualified positions with respect to graduates. However, according to the authors, PHD holders face higher levels of job instability both in the short and in the long run, without a specific advantage in terms of wages especially for those work inside the academic system.

The share of doctorate holders employed in a fixed-term employment in 2014 was 43.7% for the PhD who graduated in 2008, and 53.1% for the 2010 PhD graduates cohort. These percentages are higher than those registered in 2009, when only 35.1% of the 2004 graduates and 43.7% of the 2006 ones were employed under the same conditions (Istat 2015a). The increase in job instability among the recent cohorts of PhD holders is a trend that pertains to both researchers working within the University system and those working outside academia with a research or a non-research position (Istat 2015a; Schizzerotto 2007; Toscano et al. 2014; Argentin et al. 2014).

In relation to tasks performed at work, almost one fourth of the PhD holders do not perform any research and development activities in the immediate aftermath of their PhD graduation (Table 3) (Istat 2015a). The chances of not performing research and development tasks is higher in the disciplines that are more connected with some liberal professions (e.g., medicine). At the same time, the share of researchers who perform exclusively research and development activities has significantly reduced by 10 percentage points between 2009 and 2014 (Table 3). This indicator suggests that PhD holders face increasing difficulties to actually continue their research career as job positions available on the market do require a wider range of skills.

In this context, female PhD holders show systematic disadvantages when compared with male PhD graduates. Such disadvantages can be summarized as follows:

- Higher chances of being employed in a fixed term position: for the 2008 PhD holder cohort, the percentage of fixed term position is 48.6% for women and 38.5% for men; while for the 2010 cohort it rises to 57,6% for women and 48.4% for men (Istat 2015a:4).
- Lower average wages independently from the field of specialization (Istat, 2015, 2010) and controlling for part-time job (Istat 2010).
- Lower chances to perform research and development activities in their job or to be employed in the academic and scientific sectors. Moreover, women employed in the

[8] In 2014, 91.5% of the 2010 doctorate graduates were employed and 7% were looking for a job while the 93.3% of 2008 PhD graduates were employed and 5.4% were looking for a job.

academic system take more time to enter in a tenured position (Istat 2010; Schizzerotto 2006; Toscano et al. 2014).

- Lower chances to be involved in research activities when women have children, or when they delay the PhD graduation because of family issues. These disadvantages are more marked for women with a specialization in the natural sciences and engineering (Bozzon, Murgia, Poggio 2015). However, there is no evidences that not having children produces positive effects in climbing the career ladder (Palomba, 2008).
- Lower levels of job satisfaction with respect to career prospect, economic remuneration, autonomy, job security, tasks performed, and use of their scientific knowledge. Women results particularly unsatisfied with career opportunities and job security (Istat 2010, 2015a).

Table 4 – Distribution of different cohorts of PhD holders by the frequency they perform research and development activities in their current job (Only PhD holders employed)

	Cohort 2004 – situation in 2009 (after 5 years)			Cohort 2006 – situation in 2009 (after 3 years)		
	Male	Female	Total	Male	Female	Total
Yes, almost all the time	50.0	47.2	48.6	48.9	44.7	46.8
Yes, occasionally	28.8	25.7	27.3	28.3	26.8	27.5
No	21.2	27.2	24.1	22.9	28.5	25.7
.	Cohort 2008 – situation in 2014 (after 6 years)			Cohort 2010 – situation in 2014 (after 4 years)		
	Male	Female	Total	Male	Female	Total
Yes, almost all the time	40.8	33.9	37.3	42.5	38.2	40.3
Yes, occasionally	36.8	35.5	36.1	35.4	32.8	34.1
No	22.4	30.6	26.6	22.1	29.0	25.6

Source: for cohorts 2008 and 2010, Istat 2015a; for cohorts 2004 and 2006 our elaboration on data "Survey on Doctorate Holders' Vocational Integration – Istat, 2010" (weighted data).

3. MAPPING ORGANIZATIONAL INDICATORS

The University of Trento (UNITN) is a medium size university for the Italian context, with 16119 students and 587 professors (permanent academic staff and fixed-term assistant professors) enrolled in 10 Departments and 3 Interdepartmental Centres[9].

UNITN is one of the Italian universities with the lowest presence of women among its research and academic staff (Frattini, Rossi, 2012). In 2014, the proportion of women in whole academic staff[10] was 27% while the Italian average was 36% (Table 5 and Table 1).

[9] Over the last years the institution has undergone profound changes. The most important is the Devolution of the University: in July 2011 the Italian government approved a legislative decree which devolved to the Autonomous Province of Trento (PAT) the national normative and administrative functions pertaining to the University of Trento (d. Lgs. 142/2011) (for more details see deliverable wp7). This transition has implied an increase of the levels of autonomy of the University from the national level.

[10] Academic staff is composed by the sum of full professors, associate professors, permanent assistant professors and fixed term researchers.

Only Italian Polytechnics have a similar composition, but the University of Trento hosts 5 Departments of SSH disciplines where, as we have seen above, women are generally more represented.

The low presence of women characterizes also the gender composition of UNITN boards: at the end of 2014, women were only 20% of the total number of boards' members and within each board or committee often there is only one woman (Rapetti et al. 2015).

Fig. 2 compares the proportion of men and women in a typical academic career at the University of Trento and in Italy in 2013. The resulting diagram confirms that the scissor pattern characterizing gender unbalanced in all positions is more marked at UNITN. Thus, as it shows, the higher the position in the hierarchy, the larger the gap between the scissor's blades – i.e., the greater the inequality. In particular, the proportion of women among full and associate professors at the University of Trento is lower than that documented in Italy in 2002 for the same positions.

This situation has slightly changed during 2014. In one year, the balance between male and female among associate professors has improved whereas it has reduced by 5 percentage points among permanent researches. This change is mainly due to the unusual internal promotions of permanent assistant professors to the position of associate professors approved by the University Senate after the publication of the results of the first 'national scientific qualification' (NSQ). This internal flow has involved overall 72 permanent assistant professors (40 males + 32 females) out of the 164 (98 males + 66 females) present within UNITN at the end of 2013[11]. The transition rate for assistant professors to associate professors in 2014 was higher among women than among men (respectively 48% and 41%[12]).

This process of career advancement followed two steps. In the first step, the "Committee for recruitment and career advancement"[13] selected among permanent assistant professors with the national scientific qualification the 15 most deserving ones. These individuals have been promoted independently by the needs of their Departments. The selection criteria declared in the related documents were based on publication indexes and research quality. However, no details are provided on which dimensions have actually been considered nor on how they have been weighted. Only 3 women out of 44 (6%) with the national scientific qualification were included in the final list of the most deserving researchers, against 12 men out of the 75 granted with the same qualification (16%). Hence, research performed by women seems to be underestimated according to the organizational criteria.

In a second step, each Department proposed other cases for career advancement according to their specific research and teaching needs[14] as well as to budgetary constraints (Rapetti et al. 2015).

[11] Values derived by official documents of the Academic Senate of the University of Trento available at: http://www.unitn.it/ateneo/50721/senato-accademico. At the beginning of 2015 there were other 3 promotions (2 males 1 female).

[12] It is the ratio% between the number of male or female promoted divided by respectively the number of male and female assistant professor presented in UNITN on 31/12/2013. We have not excluded the retired in 2014.

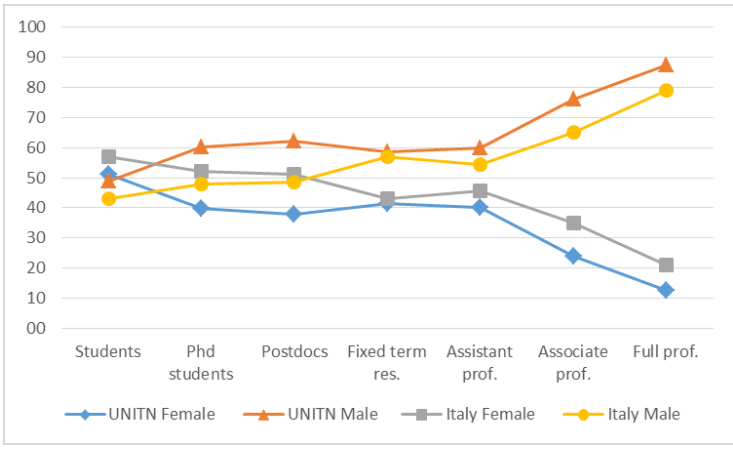
[13] The committee for recruitment and career advancement is a board that support the Governance of the University. It aims at enhancing the quality of recruitment and the advancement of the careers of professors and researchers. It is currently composed by 5 professors (4 men and a woman).

[14] In this occasion, the university senate has introduced a measure to support the call of academics of the less represented gender. University supports a quarter of the cost of all calls of less represented gender both in advancement of career and in external calls. (Rapetti et al. 2015).

These career advancements, which were not complemented by an equivalent flow from the position of associate professors to full professorship and were pursued in combination with the exit of some members from the permanent academic staff, have not helped reducing the overall vertical segregation within the University of Trento structure. On the contrary, there has been a slightly growth of the glass ceiling index due to the relative increase in the proportion of women among fixed-term assistant professors (from 21% in 2010 to 39.5% in 2014) (Table 5).

About the level of feminization of the post-doc research fellows, the recent reduction in the proportion of women is mainly due to the concentration of these positions in the scientific departments where they are generally under-represented. One fifth of the postdoc research fellows who are working at the University of Trento are part of the Department of Engineering and Computer Science. Differently from fixed term-researchers, postdoc research fellows are not part of the academic staff, but they are nonetheless involved in research activities financed by research projects. Hence, they reflect the capacity of each department to be involved in research networks and gathering research funding.

Figure 2 – Scissor diagram, University of Trento and Italy 2013



Source: For Italy: Miur data; for UNITN: Ufficio Studi.

Table 5 – Proportions of men and women in a typical academic career at the University of Trento, 2010-2014

	2010			2011			2012			2013			2014		
	M	F	F/ (M+F)%	M	F	F/ (M+F)%	M	F	F/ (M+F)%	M	F	F/ (M+F)%	M	F	F/ (M+F)%
Academic staff (a+b+c+d)	*436*	*141*	*24.4%*	*422*	*142*	*25,2%*	*425*	*147*	*25.7%*	*431*	*158*	*26.8%*	*431*	*155*	*26.5%*
Permanent positions															
- Full professors (a)	159	22	12.2%	154	23	13.0%	161	22	12.0%	155	22	12.4%	150	20	*118%*
- Associate professors (b)	137	42	23.5%	140	39	21.8%	140	43	23.5%	141	44	23.8%	181	75	*29.3%*
- Assistant professors (c)	125	73	36.9%	112	72	39.1%	100	68	40.5%	98	66	40.2%	56	31	*35.6%*
Non-permanent positions															
- Fixed -term assistant Professors type-A & B and Moratti (d)	15	4	21.1%	16	8	33.3%	24	14	36.8%	37	26	41.3%	44	29	39,7%
Postdocs	50	44	46.8%	103	74	41.8%	139	93	40.1%	176	107	37.8%	196	111	36,2%
Research collaborators involved in research activities (a)	79	63	44.4%	158	146	48.0%	234	192	45.1%	298	219	42.4%	295	244	45.3%
PhD students	302	237	44.0%	313	239	43.3%	341	236	40.9%	345	229	39.9%	376	245	39.5
N STUDENTS	7350	7876	51.7%	7648	8283	52.0%	7947	8384	51.3%	7927	8338	51.3%	7988	8131	*50,4%*
Glass Ceiling Index		*2.01*			*1.94*			*2.14*			*2.16*			*2.25*	
Glass Ceiling Index with post-docs		*2.27*			*2.24*			*2.48*			*2.45*			*2.53*	

Source: Ufficio Studi Unitn

If we move our focus onto the two Departments involved in the Garcia project, the Department of Sociology and Social Research (DSRS) and the Department of Information Engineering and Computer Science (DISI), we can notice that both of them are strongly unbalanced in terms of sex distribution across academic positions. Also, in both cases, the level of feminization of the academic staff is systematically lower than the national average of the related academic fields (Table 6 & Table 7).

The academic staff of the Department of Sociology and Social Research is composed by 33 men and 16 women. There is only one women among full professors, while 9 are currently associate professors due to the promotions obtained in 2014. However, it should be stressed that, in these case, all the permanent assistant professors who got the national scientific qualification were involved in a career advancement (Table 6).

The distribution of men and women occupying temporary positions at the DSRS is quite balanced: at the end of 2014, on 9 fixed-term assistant professors, 4 were women; and on 13 postdoc research fellows, 8 were women.

It has to be noticed that, at the time of writing (end of May 2015), the Department hosts only 7 post-doc research fellows ("assegnisti") (2 males and 5 females). In 5 months, 6 postdoc positions have expired and, out of these, 2 have been replaced with fixed-term research collaborations – i.e., temporary contracts usually put in place when research funds do not grant the coverage of 12 months of post-doc activity (that is the minimal required duration of a post-doc grant)[15].

In the Department of Information Engineering and Computer Science, the academic staff counts overall 45 members of which only 5 are women (2 associate professors and 3 assistant professors). There are no women among full professors. No women have been promoted as consequence of the national scientific qualification (Table 7).

The presence of women is relatively higher among postdoc research fellows (20%, i.e., 12 females out of 60 postdoc researchers). Interestingly, at the end of 2014, the postdocs outnumbered the members of the academic staff by 15 units. Moreover, the total amount of postdocs has tripled from 2012 to 2014. because post-doctoral positions can be financed by local, national and international funding, this trend reflects the considerable capacity of this Department to be involved in research networks and projects at all levels (indeed, in 2013 the DISI was hosting 166 active research projects[16]). Finally, this Department has an unusual high presence of foreign PhD students and postdocs if compared with the local and Italian context. As documented in the Department Strategic Plan, 60% of PhD students and 40% of postdocs come from other countries.

[15] The minimum amount of a post-doc grant is 19367 euros.

[16] For more details see Rapetti et al. 2015 and Peroni et al. 2015.

Table 6 – Proportions of men and women in a typical academic career at the Department of Sociology and Social Research, University of Trento (2012-2014)

	Department of Sociology and Social Research								
	2012			2013			2014		
	M	F	%F/TOT	M	F	%F/TOT	M	F	%F/TOT
Academic staff (a+b+c+d)	*37*	*16*	*30.2%*	*37*	*17*	*31.5%*	*33*	*16*	*32.7%*
Permanent positions									
Full prof. (a)	15	2	11,8%	14	2	12,5%	11	1	8,3%
Associate prof. (b)	9	3	25,0%	9	3	25,0%	16	9	36,0%
Assistant prof. (c)	10	10	50,0%	9	9	50,0%	1	2	66,7%
Non-permanent positions									
Fixed term assistant professors (d)	3	1	25,0%	5	3	37,5%	5	4	44,4%
Temporary research staff									
Postdocs research fellows (Assegnisti)	3	4	57,1%	6	9	60,0%	5	8	61,5%
Phd students	11	12	52,2%	7	9	56,3%	9	10	52,6%
Students	620	1341	68,4%	577	1247	68,4%	517	1128	68,6%
GCI	*2,6*			*2,5*			*3,9*		
GCI wirh post-docs	*2,8*			*3,0*			*4,6*		

Source: Ufficio Studi Unitn

Table 7 – Proportions of men and women in a typical academic career at the Department of Engineering and Computer Science of the University of Trento (2012, 20132014), and in the field of Industrial engineering.

	Department of Engineering and Computer Science								
	2012			2013			2014		
	M	F	%F/TOT	M	F	%F/TOT	M	F	%F/TOT
Academic staff (a+b+c+d)	*40*	*4*	*9.1%*	*40*	*5*	*11.1%*	*40*	*5*	*11.1%*
Permanent positions									
Full prof. (a)	11	0		10	0		10	0	
Associate prof. (b)	17	2	10,5%	18	2	10,0%	22	2	8,3%
Assistant prof. (c)	8	2	20,0%	8	2	20,0%	4	2	33,3%
Non-permanent positions									
Fixed term assistant professors (d)	4	0		4	1	20,0%	4	1	20,0%
Temporary research staff									
Postdocs research fellows (Assegnisti)	24	14	36,8%	39	11	22,0%	48	12	20,0%
Phd students	121	39	24,4%	121	43	26,2%	112	36	24,3%
Students	1046	125	10,7%	1097	150	12,0%	1161	175	13,1%

Source: Ufficio Studi Unitn

4. INTERPRETATIVE ANALYSIS

4.1 The situation in Italy

In spite of the general growth of their educational endowment and their considerable involvement in PhD programs, women continue to suffer from systematic disadvantages in career advancement. In the same way, they continue to be strongly underrepresented among the top position in the academic hierarchy. These disadvantages in the research and

development sectors and in the academic system reflect their difficulties in the wider Italian labour market[17].

In the same way, the growing levels of temporary research positions in the academic system clearly mirrors the rising levels of job insecurity that has characterized the Italian labour market over the last 20 years, which has fostered a market segmentation between fully included workers and marginal workers based on a generational divide. The new generation of workers suffers from significant disadvantages in gaining access to jobs with adequate rights and social security provisions (Bozzon et al. 2015). The situation is particularly discouraging for postdoc research fellows. Since postdoc grants ("assegni di ricerca") are not formally considered tantamount to job contracts, post-doc holders are not entitled to receive any unemployment benefit or other social security provisions. Thus, the lack of welfare supports is not compensated by higher wages but, quite the opposite, postdoc positions are considerably lower in Italy than the European average (Martucci 2011).

Job insecurity appears to be the most important barrier to pursue a research career (MORE2 2013) and produces negative consequences on researchers' ability to manage their present and future work. The lack of research funding or the non-renewal of research contracts seem to be the most important reasons motivating individuals to leave research (Toscano et al. 2014; Ajello et al. 2008).

Researchers in the early stages of their careers face stressful and pressuring contexts, as they are required to be at the same time passionate, productive, mobile, accountable, and competitive (del Rio et al., forthcoming; Peroni, 2015). The growing competition for permanent positions has produced a strong increase of pressure within the academic context where scientific production has accelerated its pace, entails competition at the national and at the international levels and imposes hyper-productivity and accountability (del Rio et al. forthcoming).

Furthermore, the limited time span of postdoc grants (usually one or two years, even if they are renewable up to 6) may affect negatively the chances to meet the expected research performance and can amplify the effects of competition and uncertainty making careers more vulnerable to an early termination. This may happen for different reasons. On one side, the need to find a new job before the current position expires overlaps with fundamental research and writing activities (Toscano et al. 2014). On the other side, unexpected events such as health problem, childbirth, or other type of events force to ease out job activities (Petersen et al. 2012; Falcinelli and Guglielmi 2014).

In this context, the general lack of social supports and unemployment provisions as well as the lack of policies and practices that are explicitly targeted to promote gender equality in academia (but also in the wider labour market), do actually increase the vulnerability of unstable workers. Toscano et al. (2014) documented that the most part of precarious researchers (84%) believe that their insecure work position is actually affecting in a negative way their work performance. Thus, they are often unable to give continuity to their job (43%) or to imagine their professional future in 10 years (50%). Temporary researchers involved in

[17] Italy continued to be among the worst performers in the Global Gender Gap Index (ranking 69th out of 142 overall in 2014), penalized above all by the economic participation and opportunity category (114th), while the gap in educational attainment was narrower (62th). Italy lags behind in women's access to the labour market, remuneration, career advancement, promotion to positions of leadership and new business initiatives (Bozzon et al. 2015).

the DISI and DSRS departments results really unsatisfied concerning the level of security and the chances of career advancements related to their job position (Figure 3)[18].

Hence, it is very likely that an increased number of postdoc researchers will have to seek jobs outside academia. In fact, it has been estimated that the current chances of recent PhDs to reach a tenure-track position is only 3.4%. Conversely, the 86,4% will exit from the Italian academic system after their period of research fellowship and the 10.2% after their period as fixed-term researcher of type A (Bonatesta et al. 2014: 33).

Relevance of research topics and the acquisition of additional skills and competences for non-academic labor markets have therefore became key challenges in doctoral education and training (Kehm 2007; Etzkowits and Ranga 2011) as well as in postdoctoral career development. Intersectorial mobility of researchers between academia and other economic sectors seems to be a growing policy priority (EU 2011). At the same time, supporting postdoc researchers in developing strategies to advance with coherent and competitive careers is even a more crucial matter.

Recent analyses on the consequences of the new rules on recruitment and career advancement introduced by the Gelmini reform shed some light on the persistence of some mechanisms that feed women's disadvantages in recruitment and selection processes.

The results of the first National Scientific Qualification pointed out a lower presence of women among Italian researchers habilitated to apply to permanent positions (associate and full professors). This result is mainly due to the lower number of female applications, rather than their lower success rate. In fact, there is only a negligible gender difference in the probability of success while the share of applicants on total 'potential candidates' is 48% among women and 54% among men (De Paola et al. 2014; Baccini and Rosselli 2014; Pautasso 2015).

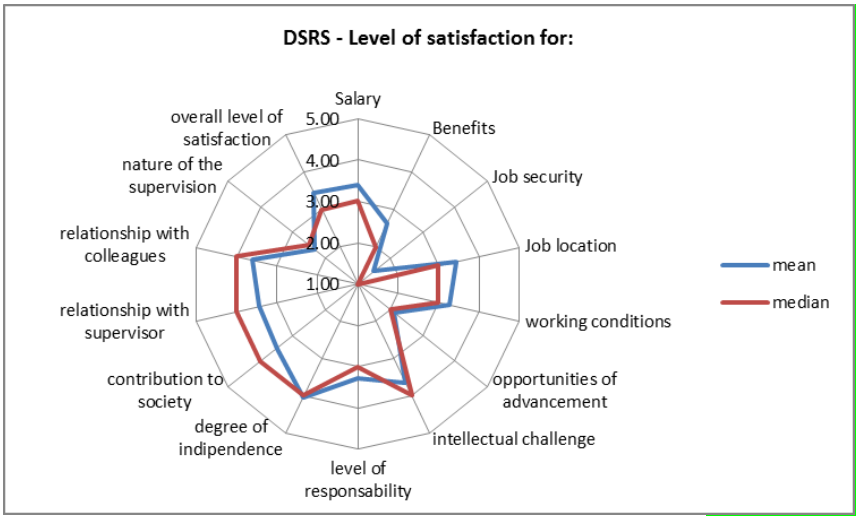
Women's aversion for risk in taking part in selections is documented also for other type of competitions, such as applications for research funding (Eu, 2013). Rather than focusing only on how to avoid gender bias in the assessment of female application, it is advisable to try to understand the reasons behind the low proportion of female applications (Pautasso 2015).

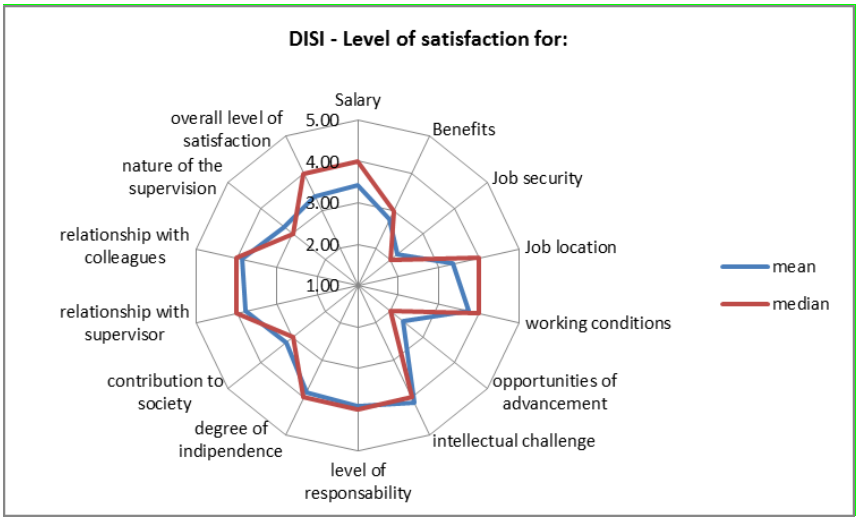
Several analyses, based on quantitative indicators, document that Italian female researchers continue to suffer from a certain productivity gap and are less competitive than men, facing *ceteris paribus* more difficulties than men in publishing (Baccini et al. 2014; D'Amico et al. 2011; Corsi and Zacchia 2014; Lissoni et al. 2011). Moreover, Lissoni et al. (2011) show that if female researchers manage to be promoted to higher ranks, then they publish as much as their male colleagues do.

Since the university system is leading to a massive use of quantitative indicators as a tool for evaluation of scientific activities at both the individual and the collective levels, it is crucial to foster the creation of networks aimed at promoting the role of women as well as their scientific production (Corsi and Zacchia 2014). At the same time, there is a deep need for a genuine knowledge on how different indicators and bibliometric databases work and may influence selection processes for different categories and scientific fields (first of all, the ones with a poor bibliometric tradition). In turn, this entails also a higher transparency in the criteria adopted and applied in the evaluation procedures both for national selections and at the organizational level (Rapetti et al. 2015).

[18] For more details on the Garcia web-survey see Chapter 9 in this report.

Figure 3 – Level of satisfaction of who is working with a temporary position (fixed term assistant professors and postdoc research fellows - for the current work position in the Garcia (1= very dissatisfied; 5=very satisfied) (DSRS n=18, DISI n=27)





Source: Garcia web-survey, 2015

4.2 The situation at the University of Trento

The picture drawn on the gender composition of the University of Trento is quite discouraging in terms of gender equality, in particular with reference to the low presence of women in the academic staff and within various governing bodies of the University, where decisions are made.

The need to reduce gender asymmetries is part of the objectives and statements included in the University Strategic Plan. However, their implementation in the actual procedures and practices is quite twisted.

In 2014, the UNITN senate has introduced a measure to support the inclusion of academics of the less represented gender with the aim to force the reduction of gender asymmetries in scientific career advancement (Rapetti et al. 2015). This measure has risen a lot of critiques within the University scientific community that has interpreted it not so much as an instrument to support gender balance but, rather, as a way to undervalue women scientific work.

Recently, the University governance has embodied the need to introduce measures to promote "merit evaluation" in recruitment and career advancement procedures as well as in procedures for funding assignment for research purpose. Quantitative indicators are systematically employed within university internal selections, even if there is still a wide debate on the definition of the type of indicators and on which are the thresholds that identify excellent performances.

Analysing the results of three internal competition for the career advancement of "excellent researcher" (see paragraph 3) and research funds allocation, Rapetti et al. (2015) point out that women result strongly underrepresented among winners.

It would be interesting to understand the reasons behind these results but, at this stage, few details are available on the evaluation criteria; on the results obtained by the selected/winner researchers and/or projects; as well as on the number and gender composition of participants. The main critique does not concern the lack of women *per se*, but it rather relates to the lack of transparency in the evaluation process (definition and application of evaluation criteria) and to the limited information about the various selection steps (Rapetti et al. 2015).

Further actions where the governance of the Trento University is putting effort to reduce gender asymmetries are: i) the constitution of CUG (Unified Committee for the Rights of the Employees)[19]; ii) the publication of the "Affirmative Action Plan 2014-2016"; and iii) the kick-off of the process to obtain the family audit certification. The effects of these actions, aimed at promoting work-life balance arrangements and increasing the level of wellbeing of men and women in the university community, will be assessed in the next years.

Certainly, a crucial point is understanding which categories are included in these activities. In fact, the majority of temporary positions, such as research and teaching collaborators and postdoc research fellows, are often excluded by or not fully included in university policies. Because postdocs are not employed with a dependent contract, they are simply not considered part of the university community.

[19] CUG (Unified Committee for the rights of the employees) combine the former CPOs (Equal Opportunity Committee) with the committees for protection against mobbing.

Such exclusion is becoming more and more problematic, in particular as postdocs are increasingly in charge of teaching and research activities. According to the data released by the Miur, in 2014, the University of Trento activated 539 collaborations to support research activities and the contracts for lecturer and teaching support in the academic year 2013/2014 were overall 957 (392 lectures and 555 tutors). Concerning post-doc research fellows, at the end of 2014 they were 307 and represented the 44% of UNITN overall research staff (academic staff + postdocs). It is therefore crucial to recognize the scientific and educational contribution that postdocs deliver to their University and thus give adequate visibility to their presence and to the role they play.

The condition of postdoc research fellows within the University organization is also quite problematic. From an organizational point of view, they are fundamental to carry on and develop research projects paid on external funding, that is one of the most important features on which the overall university performance is measured. In fact, postdoc research fellows' productivity (publications and projects funded) contributes to the department performance evaluation. At the same time, though, they are not entitled to benefit from research or mobility funds because they are not part of the dependent academic staff. Given the increasing importance of international experiences as well as of conference participation, the non-entitlement to any mobility funds limits postdocs' possibilities to improve their curricula (Rapetti et al. 2015) as well as to increase the value of their job skills, competences and productivity.

5. CONCLUSION

Early stages scientific careers in Italy are characterized by:

- The persistence and reproduction of gender asymmetries already at the early stages of career after PhD graduation.
- The rise of the level of precariousness and job instability experienced by the new generation of PhD holders.
- An increased level of competition for permanent positions that in turn follows from the inability of the University system to absorb the rising numbers of PhD holders, from the limited development of research positions in other sectors as well as from the low level of employability of doctorate holders outside academia.
- The persistence of disadvantages suffered by women both in terms of scientific productivity and during selection processes.
- The temporariness of research affects the quality of research outputs and the type of knowledge elaborated in academia.

The picture drawn in this work confirms a core statement of the leaky pipeline and glass ceiling debates. Also in the case examined the under-representation of women is drastically chronic and it will hardly self-correct in the foreseeable future (Badaloni et al. 2011; Frattini and Rossi 2012; Martucci 2011) nor it will naturally disappear over time as the numbers of women increase in the entry levels (Palomba 2001; EU 2013).

Already at early career stages, women employment positions are less stable and less paid than male ones and are more influenced by family and personal situations. These weaknesses are generally more evident in the STEM disciplines, but also the SSH fields,

where women are more represented, are not immune from unfair mechanisms that foster processes of exclusion of women from career advancements, governing bodies and positions of power.

At the institutional level, few measures are essential for improving women's status in scientific career (Etzkowitz and Ranga 2011b):

- changing recruitment, retention and assessment processes so that Universities are more transparent;
- providing equal support for men and women involved in scientific activities at every stage;
- including women in mentoring, peer review and research funding applications, gender monitoring and regular publishing of funding statistics, differentiated by discipline and research instrument.

Growing levels of precariousness and instability in the early stages of career, together with the low chances to obtain a permanent position inside the academic system, rise the necessity to support PhD holders to develop skills and competencies able to support inter-sectorial careers as well as to find effective strategies to give continuity to their personal career paths. The main idea is to overcome the linear (academic) path that underpins the leaky pipeline metaphor, moving to a non-linear model of careers across other sectors, new occupations and professions requiring scientific and research expertise (Vanish Box model) (Etzkowitz and Ranga 2011a).

The general vulnerability of postdoctoral positions ("assegnisti di ricerca") needs to be limited starting first and foremost from a redefinition of their ambiguous contractual condition. A first progress would be the inclusion of this position among the ones entitled to receive (at least) unemployment benefits, in order to better manage the high-level uncertainty that characterises (the early stages of) scientific careers.

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