

## A PROPOSAL FOR MEASURING THE LABOUR FORCE'S KNOWLEDGE OF INFORMATICS

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### **1. Introduction**

The increasing importance of ICT in a knowledge-based economy highlights the need for suitable statistical information on its development and diffusion (Romer, 1990; Foray and Lundvall, 1996; Colombo and Grilli, 2004). In Italy, some information on the use of ICT-tools and the demand for new employees with high skills in informatics is collected from two sample surveys on firms carried out by ISTAT (our National Statistical Institute) and the National Association of Chambers of Commerce. On the contrary, regarding household survey, a few questions on the use of computer and in particular of internet have been added from some years to the annual multipurpose survey on “Citizens and their leisure” (Morrone and Zanella, 2004). However, they do not provide detailed information on individual capabilities and skills.

For this reason, our work has two main aims: *i*) to identify and evaluate the labour force's competence in informatics; *ii*) to test an approach for collecting information on those capabilities through a simple, not too much expensive and repeatable survey.

Since the Italian economic landscape is characterised by the economic relevance of districts where highly specialized industries tend to be localized, (Carone and Iacobucci, 1999), the attention is focused on those areas.

In the literature, past international experiences on the study of human capabilities have been carried out above all by international organizations, using instruments which may be grouped in three main typologies: 1) psychological testing, whose object is to measure different kinds of abilities (OECD, 2002, Gallina, 2005); 2) statistical surveys collecting directly information on capabilities and skills for particular tasks (Moss and Tilly, 1996; EUSROSTAT, 2004); 3) self-evaluations of one's own capabilities and skills, often used together with one of the previous strategies (UNESCO, 2003). The first solution allows to capture very general capabilities and could be considered useful if it allows to single out some personal characteristics which may be used as proxy for the investigated abilities. An important survey based on this approach is already carried out by OECD, the Programme for International Student Assessment (PISA), whose aim is to assess how far students near the end of compulsory education have acquired some of the knowledge and skills that may be useful for full participation in society. Tests are administered to between 4,500 and 10,000 students in each of the 43 countries involved. The domains of reading, mathematical and scientific literacy are covered in terms of those knowledge and skills needed in adult life (OECD, 2002). Hence skills investigated are very general and they do not fit with the task of measuring a specific and technical capability like informatics. Moreover this approach is really time consuming, expensive and difficult to repeat.

For these reasons we found more suitable for our aims to experiment the other two strategies. We carried out in 2004 a sample surveys on labour force focusing on particular knowledge and abilities which are considered crucial in many business sectors of the new economy: those related to informatics.

The outline of the paper is as follows. Section 2 gives a description of the choices made in different stages of the sample survey (target population, sampling design, questionnaire, etc.). Section 3 provides the analysis of main results which allows us to compare the effectiveness of the survey strategies described and to study the relationship between the interviewees' level of knowledge and other characteristics as their employment status, their educational level and the district where they live. Some extensions for the analysis of information collected and some possible improvements to adopt in a possible further survey experiment are given in section 4.

## 2. The survey

For the sample survey that we carried out on informatics knowledge we chose as target-population the young people of the 22 districts of Emilia-Romagna Region. Such districts contain about 50% of the municipalities of the region and are specialized for the following kinds of productions, according to our National Statistical Institute classification: "alimentary"; "mechanical"; "furnishing"; "textile" (ISTAT, 1997). The restriction to one region was due to budget constraints while we chose to interview only young people (from 20 to 35 years old) since, for these generations, the relevance of such competence in the work market was well known from a long time.

The basic idea for the questionnaire design was to refer to the approach used for obtaining the European and Computer Driving Licence (ECDL), an internationally recognised qualification which enables people to demonstrate their competence in computer skills (Matei, 2003). In this approach the candidate has to reply to specific questions – as in any questionnaire - aimed at testing his real knowledge of some operations connected with the use of computer. On this basis we have selected six basic fields which cover the knowledge of different programmes/software usually used to solve specific problems in informatics: 1. "managing files"; 2. "word processing"; 3. "spreadsheets"; 4. "access database"; 5. "information and communication: basic web search task"; 6. "information and communication: web pages construction".

Since one of the aims of this work is to compare different survey methods, and in particular to check the reliability of self-evaluation, knowledge of the specific operation is investigated both referring to a general question based on self-evaluation and on a sequence of specific questions as explained above. The aim is to study discrepancies between the two strategies.

Moreover the questionnaire includes questions on several characteristics of the respondents and on their use of computer (frequency, places and reasons for using the computer, how they learnt to use it, if a training course has been taken). The self-valuation on different aspects of informatics knowledge is expressed as scores, in a scale from 1 to 10. Regarding the test, knowledge of informatics is valued on the basis of the number of correct answers given to each section and on the whole.

The survey has been carried out on a stratified sample survey of about 1,200 units. Strata have been defined by the already mentioned four kinds of production which characterised the districts. The sample size allows to obtain reliable results for each strata<sup>1</sup>. The interviews allocation per district within each stratum is so as to keep constant the district estimates' standard error within the stratum. The same condition is valid for the municipality estimates' standard error within each district. That choice implies an equal number of interviews in each municipality of the same district and an equal number of interviews in each district of the same stratum.

A CATI (Computer Assisted Telephone Interview) technique was used. Since the list of persons within the range of age of interest is obviously not available, households have been selected randomly from telephone directories and then eligible household's members have been interviewed.

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<sup>1</sup> The strata sample dimension has been chosen so as to obtain estimates of a proportion per stratum with a sampling error which overcomes 6% with a probability equal to 0.05. This involved the execution of about 300 interviews for each of the four strata.

On the whole 9974 telephone numbers have been called. In 67% of the cases there was no person in the range of age of interest, in 2% of the cases the telephone number was incorrect, in 12% of the cases nobody was found at home in four attempts and in 10% of the cases the young person found at home refused to participate. The effective sample size (1,157) is slightly lower than the programmed one. However, to provide estimates for the population, sample units have been weighted according to results coming from last Census, which are referred to 2001. The sample structure was adjusted according to gender and quinquennial ranges of age within each district (the only two information available till now for districts). In each of the post-stratum so defined, weights have been calculated as ratio between the number of persons in the population and the number of persons in the sample, taking into account of the three years difference between the results coming from the two sources.

A comparison between the sample structure and the population one with respect to other characteristics as the instruction level or the employment status is not straightforward, since those information is available from the last Census only at regional and provincial level. The districts considered are groups of municipalities defined on the basis of the importance of workers commuting towards a municipality. Such districts include the 48% of the whole regional population.

However a comparison between our sample results and the Emilia-Romagna Census results points out that our sample has a higher percentage of persons with a upper secondary education (63%) to the detriment of the lower secondary education (22%) than the regional population where those percentage are 53% and 32% respectively. Besides, our sample is found to have a smaller percentage of labour force (75%) than the regional population where this percentage is 82%. Differences observed could be due to the territorial concentration of high educated persons and students in districts which are often secondary school and university poles.

### **3. The results**

In this section some of the main results are illustrated, according to the following outline. First of all some results about the use of computer are reported: frequency of use, where and why it is used, how competence in computer skills has been achieved, participation in courses on computer use, etc. (par. 3.1). Then a comparison between results obtained by the two used strategies is carried out (par. 3.2). An analysis of the interviewed persons' characteristics which have a significant influence on their competence is given in paragraph 3.3. Finally, paragraph 3.4 provides a picture of different patterns of competence that respondents demonstrate to have in the six questionnaire sections.

#### *3.1. About the use of PC.*

Regarding the use of computer, the sample is divided among three different groups: about 2/3 (60%) uses it daily, 20% use it only from time to time and the remaining 20% never use it. The first evidence show that a very large fraction of the population considered uses PC (80%, 927 persons). One or more training courses providing a certificate have been taken by 22% of the sample. Looking at the year when the last training course has been taken, it is possible to note a concentration of those last courses in correspondence of some years, as 2000 (12%), 2002(17%) and 2003 (13%).

Among different operative systems, Windows is the most used. It is used by 99% of the computer users (915) who are the only interviewees that respond to the rest of the questions on informatics knowledge.

The computer is used at home by the 83% of the respondents, at school by the 67% of the respondent who are students and at work by the 81% of the respondents who are employees.

It is used for entertainment reasons by 87% of the respondents, for work reasons by the 86% of the respondents who work.

Then it has been asked to subdivide a 100% percentage in the contribution to one's own knowledge of informatics derived from: training at school, training at work, other courses attended on one's own initiative, self-learning. This analysis has been carried out for "employees and unemployed persons" and for "students and persons looking for the first job" separately, since the last ones had obviously given a zero percentage to the training on job. Results on average are reported in table 1.

*Table 1: Averages of percentages assigned to different ways of learning for one's own knowledge*

	Employees and unemployed persons	Students and persons looking for the first job
Training on job	34	-
Training at school	14	33
Other courses	7	7
Self-learning	45	60

"Self-learning" is considered by both categories of respondents the most important way of getting and improving informatics knowledge, followed by the "training on job" for workers and by "training at school" for students. If the analysis of contribution assigned to "other courses" is restricted to those who stated they have taken a training courses providing a certificate, the average of percentages grows up to 21% for employees and unemployed persons and to 28% for students and persons looking for the first job, but the modality considered more effective remains "self-learning".

### *3.2. The evaluation of competence in computer skills: self-evaluation and test<sup>2</sup>.*

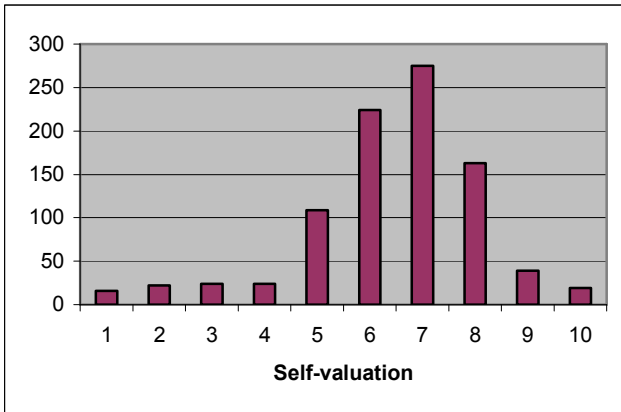
Respondents were asked to assign an evaluation in the form of scores, in a scale from 1 to 10, to: *i*) their general informatics knowledge; *ii*) their competence regarding the following aspects: "managing files", "word processing", "spreadsheets", "access database", "basic web search task" and "web pages construction", which represent six different sections of the questionnaire. Those sections, besides including the self-valuation, incorporate the test with five questions for each section. Hence it is possible to evaluate the specific competence mentioned above also by using the number of correct answers given to each section (from 0 to 5) and the number of correct answers given in the whole (from 0 to 30). These numbers will be called "scores".

First of all we will carried out an analysis of results related to general knowledge and then we will continue with those obtained from the specific sections.

Self-valuation of respondents follows the distribution reported in Figure 1a. The mean evaluation is 6.4 and the standard deviation (which measures the variability around the mean) is 1.7. We may try to compare this result with that obtained for the whole score, whose distribution is reported in Figure 1b, even though this comparison is not straightforward since the two variables have different ranges of variation. The score mean is 10.6 and its standard deviation is 5.1. Both distribution seem to have one mode (they both increase up to the mode and then decrease) but the score distribution appears more variable than the self-valuation one also in relative terms, since the coefficient of variation (given by the ratio between the standard deviation and the mean) is higher for score (48%) than for self-valuation (26%). It is to stress that no one in the sample gave the correct answer to all 30 questions of the test. The best performance (relative maximum) corresponds to 27 correct answers.

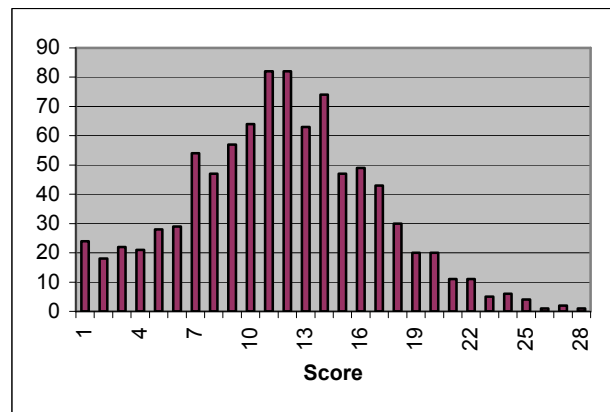
<sup>2</sup> Interviewed persons declaring not to use computer are excluded from this analysis.

Figure 1a: Self-valuation distribution\*



\* Mean = 6.4    Median = 7    Mode = 7  
 Standard deviation = 1.7  
 Coefficient of variation = 26%

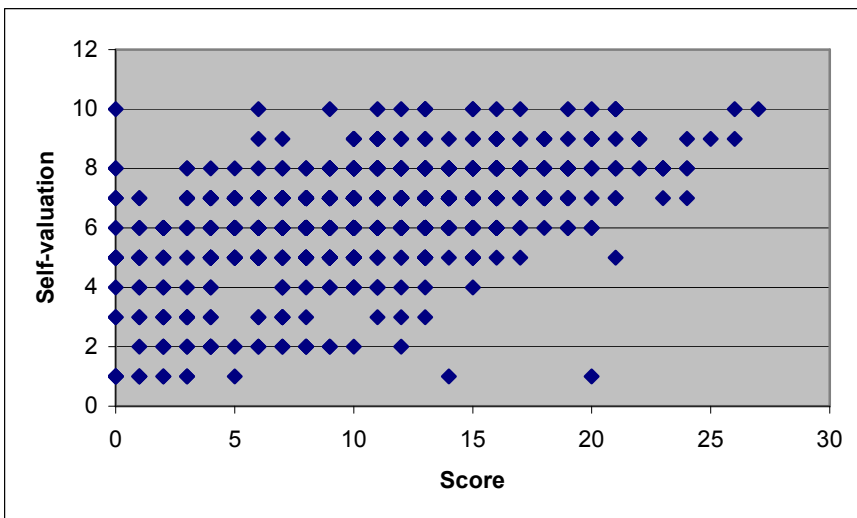
Figure 1b: Score distribution\*\*



\*\* Mean = 10.6    Median = 11    Mode = 10  
 Standard deviation = 5.1  
 Coefficient of variation = 48%

The concordance between results obtained from the two evaluation strategies is highlighted by the following scatter-plot (Figure 2), where respondents are represented according to both self-valuation and score. The coefficient of correlation ( $\rho$ ) between these variable is 0.54, therefore the concordance is not very high (about 50% of the maximum). Discrepancies between self-evaluation and the test involved 30% of interviewees, showing a quite high fraction of persons is not able to give a proper evaluation of their skills and throwing some serious doubts on surveys using such approach. Most of discrepancies derived from respondents who evaluate themselves better than their performance in the test. Percentage of units whose self-valuation overcomes the correspondent mean while score is less than the mean is 17%. Percentage of cases where the contrary happens is 13%. This result may be influenced by the choice to put the self-valuation question before the test, hence respondents provide an overall evaluation for their competence without knowing the specific skills investigated by the test. We consider such approach in the sequence of questions correct, in any case, this warning does not change our consideration on the reliability of self-evaluation.

Figure 2: Scatter-plot for self-evaluation against score



The comparison between the two evaluation strategies may be deepened on the basis of the results obtained from the six specific sections of the questionnaire, which are given in Table 2. In this case,

the range of values for the self-valuation is still 1-10 while score varies from 0 (no one correct answers) to 5 (all answers given to the section are correct) since we have 5 questions per section.

Not all the 915 interviewees who state their using of computer respond to all sections. They do not respond to sections related to knowledge of informatics they think they do not have at all. In particular, the respondents to the last two sections “access database” and “web page construction” decrease sharply, showing that these two capabilities are quite rare in the population considered. The number of respondents to each section is reported beside each sections name.

*Table 2: Results obtained for self-valuation and score from the six specific sections*

MANAGING FILES (n = 888; $\rho = 0.58$ )			
	Mean	Coefficient of variation	Range
Self-valuation	6.8	35%	1-10
Score	2.9	52%	0-5
WORD PROCESSING (n = 842; $\rho = 0.62$ )			
	Mean	Coefficient of variation	Range
Self-valuation	6.3	40%	1-10
Score	2.8	46%	0-5
SPREADSHEETS (n = 692; $\rho = 0.72$ )			
	Mean	Coefficient of variation	Range
Self-valuation	4.3	67%	1-10
Score	1.8	89%	0-5
BASIC WEB SEARCH (n = 825; $\rho = 0.61$ )			
	Mean	Coefficient of variation	Range
Self-valuation	5.8	43%	1-10
Score	2.5	52%	0-5
ACCESS DATABASE (n = 167; $\rho = 0.86$ )			
	Mean	Coefficient of variation	Range
Self-valuation	0.9	244%	1-10
Score	0.4	250%	0-5
WEB PAGE CONSTRUCTION (n = 106 ; $\rho = 0.89$ )			
	Mean	Coefficient of variation	Range
Self-valuation	0.6	300%	1-10
Score	0.2	400%	0-5

The coefficient of correlation between self-valuation and score,  $\rho$ , may be read at the top of the section. When “access database” and “web page construction” are considered it has been found that the correlation is high (0.86 and 0.89), probably because these tools are more sophisticated applications of informatics and less spread, moreover people seems more aware of difficulties and of their real skill. On the contrary results are less correlated for the sections “managing file” (0.58), “word processing” (0.62) and “basic web search” (0.61), where sometimes low scores tend to be associated to high self-valuations.

### 3.3. The determinants of competence

Another important aspect considered is the influence that the respondents’ characteristics have on their knowledge, i.e. on their self-valuation and on the score they get from the test.

To establish if different respondents’ characteristics have a significant influence on their competence we carried out the “analysis of variance test” (ANOVA) (Turner and Thayer, 2001). In this analysis, means of a variable of interest (the self-valuation or the score) obtained by sub-groups of the respondents defined by the modalities of one of their characteristics (for instance, their educational level, their employment status, etc.) are compared by using an F-test. The null hypothesis of the test is that all those means are equal in the population (and, consequently, differences in the sample means are due only to the sampling error). This hypothesis is checked against the alternative one that the population means are not all equal. If the null hypothesis is

rejected, it means the characteristic used to create sub-groups has an influence on the variable of interest, since the mean of that variable assume for those groups values which differs each others significantly.

The characteristics used in this analysis and the decision taken on the null hypothesis of the test are reported in table 3.

*Table 3: Analysis of variance results (null hypothesis: means are equal)*

Characteristic	SELF-VALUATION	SCORE
Gender	Rejected	Rejected
Quinquennial ranges of age	Accepted	Accepted
Educational level	Rejected	Rejected
Employment status (labour force, non labour force)	Accepted	Accepted
Kind of job* (self-employed, employee)	Accepted	Accepted
Occupation* (classification ISCO88)	Rejected	Rejected
Sector of activity* (classification ATECO 2002)	Rejected	Rejected
District	Rejected	Accepted
Kind of district	Rejected	Accepted
Having taken training courses (yes/no)	Rejected	Rejected
Frequency of computer use (daily, from time to time)	Rejected	Rejected
Use of computer at work* (yes/no)	Rejected	Rejected
Use of computer at home (yes/no)	Rejected	Rejected
Use of computer at school** (yes/no)	Accepted	Accepted
Use of computer for work reasons* (yes/no)	Rejected	Rejected
Use of computer for study, entertainment or information reasons (yes/no)	Rejected	Rejected

\* Only for employees and unemployed persons.

\*\* Only for students.

Some of these results were expected while some others are somewhat surprising. First of all a brief comment to the expected results. It is quite obvious that variables connected to the use of computer such as “having taken a training course”, “the frequency of computer use”, “the use of computer at work” or “at home”, “the use of computer for work reasons” or “for study, entertainment or information reasons” do influence the respondents’ skills. On the contrary, it is amazing to see that using the computer at school or not does not influence significantly the result of the test for the students (228). Evidence suggest that for young people school is not important in learning informatics, but probably self-learning or learning assisted by parents/friends is more effective, or also that school does not have adequate informatics devices.

It is possible to evaluate the influence of these characteristics connected to the use of computer on the basis of the differences between the group means compared by the test. Those group means are given in table 4, where the results of the analysis of variance test are provided for those characteristics leading to the rejection of the null hypothesis. In particular, regarding the mentioned variable, it is possible to note that the main differences between score means concern the “frequency of computer use” and “the use of computer for study, entertainment or information reasons”. The use of computer daily leads to an increment of the whole score obtained, on average, of about 5 points, that means about 5 correct answers more than persons who use computer from time to time. About the same increment of the score average is connected to the use of computer for study, entertainment or information reasons in comparison to the absence of this kind of use. As a consequence, we draw that it is not enough to know how many computers are in the households to understand the degree of informatics capabilities of labour force. Testing the skills, seems much more important.

Looking at the other characteristics it is possible to observe that the gender and the educational level have a significant effect on both self-valuation and score, while age is no an influencing factor. This last result contradicts findings of studies carried out on more general life skills (prose literacy, document literacy, numeracy and problem solving) (Gallina, 2005). According to the findings of those studies, persons aged from 16 to 25 years old are less skilled than older persons, that is

persons aged from 26 to 35 years old, and this holds for different countries. On the contrary, the result obtained for gender agrees with findings of those other studies. Men give on average 2.6 correct answers more than women. Someone (Gallina, 2005) explains such a difference referring to the greater opportunities of education, training and work that men still have in comparison with women, but Gallina was referring to Italy as a whole, while our survey was carried out in Emilia Romagna, where differences between genders in education and in the labour market are supposed quite small especially among young people who are our target population.

Regarding the score average obtained for different educational level, it obviously increases with the orderly modalities of this characteristic. The increment is of about 2.5 points going from “up to lower secondary education” to “upper secondary education” and of about other 2.5 points going from this last modality to the modality “degree”.

Also the “occupation” and the “sector of activity” have a significant influence on the self-valuation and the score. In particular, our expectations were confirmed. Professions that obtained the highest score means are “technicians and associate professionals” (12.5) and “clerks” (12.2), while those connected to lowest score means are “service workers and shop and market sales workers” (6.4) and “elementary occupations” (6.3). The category of “legislators, senior officials, managers and professionals” reaches a high result (10.9), but it is not the highest one, as one could have been expected. Besides, respondents of the categories “craft and related trades workers” and “plant and machine operators and assemblers” give to themselves the lowest valuation on average (5.4 and 5.2 respectively), while their average performance at the test is not the worst (8.9 and 8.7 respectively).

Regarding the “sector of activity”, the highest score averages are obtained by persons working in the “finance” (14.3) and in the “real estate activities, hire, informatics, research, enterprise services” (13.2) sectors. This is not surprising if we think these are sectors where informatics knowledge should be often necessary. Similarly, it is not surprising the worst performances related to persons working in the “hotels and restaurants” (7.7) and “health and social assistance” (6.8) sectors, where probably other sort of skills are more relevant than the abilities in using the computer. For this variable the most relevant discrepancy between self-valuation and score regards the respondents working in the “finance” sector, whose self-valuation average is one of the lowest (6.1) while, as we have already seen, their score average is the highest one (14.3).

Finally, the ANOVA test suggests “district” and the “kind of district”, which are characteristics of the municipalities where the respondents live, have a significant influence on the self-valuation but not on the score obtained by the test. In table 4 are reported results only for the “kind of district”, which are defined as groups of the 22 specialised districts of the Region. The highest means of self-valuation are obtained for districts characterised by “furnishing” (6.6) and “textile” (6.6), while the lowest is connected to the “alimentary” characterisation (6.0). This evidence is very difficult to explain and ask for a deeper analysis.

*Table 4: Analysis of variance test results for characteristics with significant differences between group means*

CHARACTERISTIC	MODALITIES (n)	MEAN OF SELF-VALUATION	MEAN OF SCORE
Gender	Male (399)	6.5	12.2
	Female (516)	6.2	9.6
Educational level	Up to lower secondary education (132)	5.6	8.5
	Upper secondary education (616)	6.3	10.9
	Degree (163)	6.9	13.1
Occupation*	Legislators, senior officials, managers and professionals (37)	6.4	10.9
	Technicians and associate professionals (94)	6.9	12.5
	Clerks (237)	6.7	12.2
	Service workers and shop and market sales workers (42)	5.8	6.4
	Craft and related trades workers (15)	5.4	8.9
	Plant and machine operators and assemblers (93)	5.2	8.7
	Elementary occupations (14)	5.4	6.3
Sector of activity*	Agriculture (13)	6.7	10.5
	Manufacturing industries (202)	6.0	10.5
	Mining; production and distribution of electric power, gas and water (9)	<b>5.0</b>	8.5
	Buildings (26)	6.9	12.1
	Wholesale and retail trade (107)	6.1	9.1
	Hotels and restaurants (15)	5.1	7.7
	Transport, storage and communication (20)	6.6	11.6
	Finance (29)	6.1	14.3
	Real estate activities, hire, informatics, research, enterprise services (120)	7.1	13.2
	Public administration (36)	6.6	12.6
	Instruction (32)	6.2	9.9
	Health and social assistance (25)	5.5	6.8
	Other public, social and personal services (21)	6.4	9.1
Kind of district	Alimentary (211)	6.0	-
	Mechanical (237)	6.4	-
	Furnishing (231)	6.6	-
	Textile (236)	6.6	-
To have taken a traing course	Yes (241)	6.8	12.4
	No (674)	6.2	10.5
Frequency of computer use	Daily (685)	6.8	12.0
	From time ti time (230)	5.0	7.2
Use of computer at work*	Yes (541)	6.5	11.4
	No (125)	5.4	8.8
Use of computer at home	Yes (757)	6.4	11.4
	No (158)	6.0	8.6
Use of computer for work reasons*	Yes (571)	6.5	11.2
	No (95)	5.1	9.1
Use of computer for study, entertainment or information reasons	Yes (793)	6.4	11.6
	No (122)	5.9	6.8

\* Only for employees and unemployed persons.

### *3.4. The analisys of different patterns of demonstrated competence.*

In order to carried out an analysis of the different combinations of competence that respondents demonstrated to have in the different sections, we adopted a standard to establish if a respondent

has a good knowledge of tools investigated in each section or not. The chosen standard works as follows:

- if a respondent gave at least three correct answers to the five questions of a section he was considered sufficient;
- otherwise he was considered insufficient.

Since the sections are six, following this approach we get a total of  $2^6 = 64$  different patterns. Among those possible patterns, 48 are followed by at least one respondent (the other 16 have frequency equal to 0), pointing out a large variety of combination of competencies.

The most relevant patterns are reported in the table 5. Patterns observed for a very small number of respondents have been omitted (less than 1% of the set of 915 respondents). Then the table refers to a sub-sample of 887 units.

*Table 5: Different patterns of performances (S = sufficient; I = insufficient)*

N. of pattern	MANAGING FILES	WORD PROCESSING	SPREAD-SHEETS	BASIC WEB-SEARCH	ACCESS DATA-BASE	WEB PAGE CONSTRUC-TION	%
1	I	I	I	I	I	I	14.5
2	S	I	I	I	I	I	4.7
3	I	S	I	I	I	I	5.1
4	I	I	S	I	I	I	1.0
5	I	I	I	S	I	I	4.9
6	S	S	I	I	I	I	8.6
7	S	I	S	I	I	I	1.0
8	S	I	I	S	I	I	5.4
9	I	S	S	I	I	I	1.5
10	I	S	I	S	I	I	4.9
11	I	I	S	S	I	I	1.3
12	S	S	S	I	I	I	3.9
13	S	S	I	S	I	I	14.8
14	S	I	S	S	I	I	1.9
15	I	S	S	S	I	I	2.4
16	S	S	I	S	I	S	1.2
17	S	S	S	S	I	I	14.1
18	S	S	S	S	S	I	3.4
19	S	S	S	S	I	S	1.2
20	S	S	S	S	S	S	1.1

The most relevant patterns observed concern: respondents considered insufficient in all the six sections (14.5%); respondents considered sufficient in the three sections “managing files”, “word processing” and “basic web-search” (14.8%); respondents considered sufficient in the four sections “managing files”, “word processing”, “spreadsheets” and “basic web-search” (14.1%).

Moreover is to be noted the high percentage of respondents (15.7%) who result sufficient in just one section (patterns 2-5) which may be “managing files” or “word processing” or “spreadsheets” or “basic web-search”. Other high percentages, 22.7% and 23%, identify a consistent set of individuals able to pass the test in just a couple of sections (patterns 6-11) and in three sections (patterns 12-15) respectively.

Findings arising from our study point out some interesting aspects concerning people capabilities in informatics. First of all, a not negligible fraction of the population (about 15%) believes to have some capabilities but when is asked to give specific answers showing their real skills they fail completely. Moreover other 16% passed the test in just one section. Probably, they need to be able to use just one program/software for work reasons (word, spreadsheets, etc.) or for entertainment reasons (basic web-search). Secondly, the absence of a “hierarchy” among various skills arises, in fact the most relevant patterns are combinations of capabilities which do not seem to depend on each other. Thirdly three kinds of competence prevail, those related to “managing files”, “word processing” and “basic web-search”, which “cross over” most of the patterns, combining each time

with the skills arising from the other sections. Finally, knowledge on dealing with databases and building web pages are very rare, as it is shown by the very low percentages of respondents passing the tests in these sections (see tab 6). Lack in this kinds of skills, that are considered very important for business in the new economy, may indicates a gap of education and a problem for business looking for qualified workers or even the lack of a demand from business of these knowledge.

*Table 6: Demonstrated competence per section*

SECTION	n	%
Managing files	582	63.6
Word processing	592	64.7
Spreadsheets	493	34.2
Basic web-search	529	57.8
Access database	147	7.4
Web page construction	98	4.0

#### 4. Concluding remarks and future work

This paper presents the results of a survey carried out to evaluate personal skills in using computer, in the specialised districts of the Emilia-Romagna Region. We had to main goals: *i*) evaluating informatics skills of a large part of the population in a rich and high industrialised area of Italy, in order to obtain information on the Italian economy to tackle with challenges proposed by the new economy; *ii*) to experiment a measurement strategy able to evaluate skills using a quite traditional questionnaire but avoiding the traditional psychological approach to the evaluation of skills that is time consuming, expensive and asks for very qualified staff. The idea was to test an instrument able to be applied frequently and if it is possible in connection with traditional labour force surveys, in order to obtain reliable statistics on human capital's real skills. Moreover, we were interested in checking the reliability of self-evaluations about personal skills, because of the difficulty of evaluating properly one's own capabilities.

To this purpose we designed a questionnaire where questions concerning the knowledge of some important and general informatics-tools – inspired to European and Computer Driving Licence - were asked. Like in a written examination, a criteria to judge individual skills was the number of correct answers. Results of the test were compared with those obtained from the self-evaluations.

The results of the experiment have been very useful and encouraging. People did not refused the questionnaire and was involved and interested in the surveys. The average duration of each interview was about 20 minutes. So that it seems clear that it is possible to extend the approach proposed here. The reliability of self-evaluation does not seems goods, in too much cases people gave an evaluation of their skills not confirmed by the answers given to the specific questions on the topics considered. So that we needs to make a warning on the use of self-evaluation in the field of skills measurement.

On the basis of the findings presented we feel that our approach could be proposed to collect data on other particular competence and skills. Since this information is usually asked to employers (Grubb, 1996; Moss and Tilly, 1996) and not to labour force, these results may constitute a basis for a benchmark between demand and offer of knowledge of informatics in the labour market.

Regarding the evidence stemming from the survey, some important issue were found. In front of a seeming wide utilisation of the computer, we found that real knowledge of informatics is limited to some small subset of the whole population. On the other hand about 1/3 of the sample does not pass the test in any sections or just in one. Even if a deeper analysis it is necessary to draw some final conclusions, especially studying the characteristics of groups of persons who demonstrate approximately the same comptence, we think that an issue arises from our data: schools and business need to make a serious and joint effort to improve informatics teaching.

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