

MONODZUKURI

Global Survey

2006 edition:

Comparison between Italian and Japanese results

March the 20th, 2007



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Forward

This report contains results from the *Monodzukuri Global Survey (Edition 2006)*, an international research intended to record the current state of operations within manufacturing industries, promoted by JMA Consultant Inc. and conducted in Italy by JMAC Europe Milano S.p.A. in partnership with the Management Engineering Department of Milan's University Polytechnic and Oracle Italia.

Of the former partners, JMAC has a long background of experiences and knowledge in operations management and other fields. Born in 1942 as JMA (Japan Management Association), it held a major role in the post-war reconstruction period as well as the following development of Nipponese industry. In 1980 was founded JMA Consultants Inc. (JMAC), a private equity society that in 1988 founded the actual JMAC Europe Milano S.p.A..

The "Dipartimento di Ingegneria Gestionale" of Milan's Polytechnic carries on research activities in management, economy, industrial engineering and held the PHD in "Ingegneria Gestionale".

Together with MIP (the business school of Milan's Polytechnic), it is part of "School of management", which held the multiple activities of research and teaching in management field of Milan's Polytechnic.

Let us get down to the specific findings of the *Monodzukuri Global Survey*.

This research follows suit from the 2003 edition, which was conducted only within the boundaries of Japan. Considering the great success the initiative was actually met with, for the 2006 edition, it had been decided to expand the area of investigation and analysis well beyond Japan, thus including also Italy, China, South Korea and the United States.

In order to understand the goals of the *Monodzukuri Global Survey*, the first step to undertake is to analyse the term Monodzukuri itself. To do this it is essential to grasp the exact meaning Japanese people actually attribute to this word. It is not so simple to define it though, due to the great semantic complexity of ideograms. First of all, it has to be said that in Japanese writing there is a tendency to associate two or more ideographic signs to achieve meaning. Therefore, using only two or three characters a whole concept can be expressed. Such synthesis can seldom be achieved using Latin characters. Furthermore, having a range of more than 20.000 characters available, there is ample scope for innumerable associations to be made, which will correspond to emerging ways of living and innovative human actions accordingly. Often, associations can be the outcome of creative thinking, of differing degrees in personal sensitivity, of individual genius or, quite simply, due to the whim of the speaker.

The specific case of the term "*Monozukuri*" can be though as emblematic of such concise expressiveness. It consists of two phonemes. The first one is 物 "*mono*", which means: thing, object, a physical or material asset. The second ideographic character is read "*tsukuri*", which due to its assonance often becomes "*zukuri*". But,

whilst the pronunciation of this second phoneme is clear and it is shared by all, the same cannot be said for the way in which it can be written. This can take different forms:

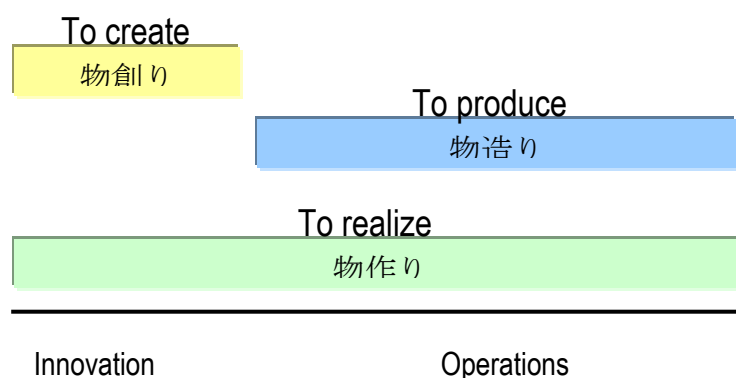
作り or 造り or even 創り.

The first meaning related to the former ideographic symbol is *doing*, intended as *elaborating, building or organizing something and bringing it to completion by grouping together several elements*. When related to a company, one could say it represents the most executive slant of constructive doing, and that it refers specifically to clear-cut operations.

The second way of writing and interpreting semantically the phoneme “*tsukur*” is probably the most frequently used one. Broadly speaking, it still refers to the verb *doing*, but the emphasis is placed on *realization* which implies *doing something from beginning to end*. Embedding it into the industrial context it would signify: *from design to production*. To put it simply: *thought...done*. Within the company context the verb is referred less to *productive and organizational doing* (typical of production) rather than *having ideas and re-organizing things accordingly*. Briefly speaking, it emphasizes *realizability* more than *realization*.

To some people these expressive possibilities were not enough...which is why on the world wide web, in editorial publications and in academic literature, one can find yet another interpretation of *doing* referred principally to contexts where it can stand for *creating, thinking up something which may lend itself to proposal and realization*.

Graphical explanation of the term “monodzukuri”



Is there something significant these interpretations could convey, or should they be taken as mere whimsical spotting of minimal differences?

First of all the compounded term suggests it can be applied to one or more dimensions together, depending on the time period, the context and expressive sensibility, referred to.

An important consideration is that the term may be used, on one hand, to describe the range of activities which pertain to the realm of doing things and, on the other hand, the degree of accuracy which may be achieved within the same realms according to a usefulness criteria.

What about the *Monozukuri* yonder?...Someone has already provided a response to *Monozukuri* 物造り with another *Monozukuri* 者造り or, yet again, *Hitozukuri* 人造り. Careful though: combining them together brings one already yonder...now one is talking about *realizing people*.

May one end this forward by thanking all those who have participated to the survey by patiently filling in the questionnaires sent to them.

One is most grateful to all those people who worked or contributed in some way to the realization of the questionnaire and the subsequent report produced on the basis of results. Amongst everyone, a special thank you to: Fabio Salomone, Giulio Contini, Daniele Giani, Carlo Magni (members of JMAC Europe Milano S.p.A.); and also Federico Caniato (PhD.), Professor Raffaella Cagliano, Professor Gianluca Spina (academics at the University of Milan's Polytechnic); finally, least but not last, Livio Signorelli (member of Oracle Italia).

Milan, 2nd April 2007

JMAC Europe Milano S.p.A.

1 Executive Summary

Monodzukuri Global Survey has been promoted with the aim of study which are the most important critical aspects in Operations for Italian companies, which will be in the next three years and which improving actions will be taken to deal with these aspects. The international connotation of the research allowed the comparison between Italian results with the ones of Japanese sample to see the similarities and the differences between the two samples.

The survey shown that there are 4 main subjects of interest:

Cost control: identified as the most important critical aspect in operations both actually and in the next three years by Italian and Japanese samples, is a classical operation theme. Having a constant control on costs is necessary for each company to be competitive.

Quality: a very strong focus on quality and a continuous improvement of this performance is one of the greatest difference between Japanese sample (that achieved a claim reduction of 18% in the last three years) and Italian one. Analysing the sub-group of Italian “high performer”, is evident that the greatest difference with the rest of the sample (and, in particular, with low performer) is the great attention they pay on quality. It is possible to deduce that quality is directly related with company’s overall performances.

Flexibility: the need of wider products families, shorter life cycle and constant variations on productive mix made flexibility one of the most important aspects in operations management. This aspect is much more “critical” for Italian companies than for Japanese ones: this is probably due to the fact that Japanese companies have an higher productive flexibility that is due to years of constant application of optimization techniques like TPM (*Total Productive Maintenance*) RTS (*Setup Times Reduction*) etc.

Research and Development: the lack of cooperation between R&D and the other functions that are part of Operations is the most unexpected result of *Monodzukuri Global Survey*. R&D is seen by Italian companies as something apart from operations, a function separated from productive system, that usually works in total autonomy. This view cause longer development times for new products, higher production costs and lower quality levels especially for new products. Japanese companies, on the other hand, have a stronger integration between R&D and Operations, and they will try to enhance this integration in the next three years adopting concurrent engineering and enhancing the cooperation with productive functions from the initial phases of new product development.

The research finally shows that companies are aware of these problems and, in most of the cases, have already planned very structured plans to solve them, using (in particular) techniques of Japanese derivation, like TPM, lean production, kaizen etc. sided by investments in information technologies aimed to enhance their data gathering and analysis capability.

2 Introduction

2.1 Purposes of *MONODZUKURI Global Survey*

The purposes of *Monodzukuri Global Survey* are 5:

1. Study the actual situation of Monodzukuri in manufacturing companies
2. Understand the main critical aspects that these companies have to face nowadays
3. Understand which actions will be done in the next three years to solve the critical aspects analyzed in point 2
4. Understand which will be the main critical aspects that the companies will have to face in the next three years
5. Make a comparison between Italy and Japan about the four points listed above

2.2 Survey details

In the survey, the following aspects have been analysed:

1. Performance indicators used to evaluate operations results
2. Changes in QCD (quality/cost/delivery) levels
3. Scope of Operations-Monodzukuri
4. Main critical aspects of Operations-Monodzukuri
5. Improvement plans and actions planned for the next three years to solve these critical aspects

2.3 Methodological aspects

The method chosen to conduct the research is the survey.

Object of the research are manufacturing companies with more than 80 employees.

The method used is a questionnaire. The questionnaire comes from the Japanese version, integrated in some aspects to fit the Italian industrial context.

Research data:

Italy

Data collection period: September 2006 – March 2007

Number of postings: ~600

Number of responses: 51

Response rate: ~8,5%

Japan

May 2006 – July 2006

~6000

474

~7,9%

3 Sample overview

In the first section of this report some general information about the two samples will be given, in order to compare them and understand if they're similar and comparable. Profitability and the number of employees of the companies of the two samples will be analysed.

3.1 Number of employees

Diagrams 1 and 2 show the number of employees of the companies:

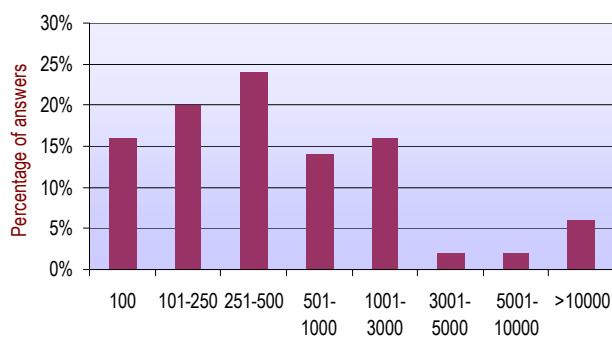


Diagram 1: number of employees, Italy

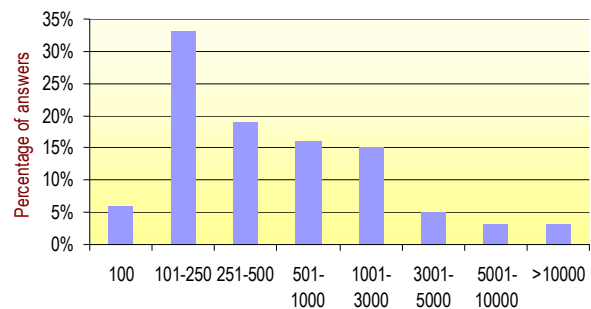


Diagram 2: number of employees, Japan

Regarding the number of employees, the two samples are similar: the mean number of employees is 850 for Italian companies, and nearly 1000 for Japanese ones¹.

Moreover, 60% of Italian companies and 58% of Japanese ones have a number of employees between 80 and 500. In this range, most of the Japanese companies have 101-250 employees, while the Italian ones are distributed in an uniform way, with a slight prevalence on the class 251-500.

This result is very important, because we thought that the size of companies could be one of the greatest differences between the two samples, with very big Japanese companies compared with little Italian ones (making the comparison not meaningful).

¹ This mean number has been calculated without the "more than 10.000" companies

3.2 Profitability

The second analysis, shown in Diagrams 3 and 4, is about profitability:

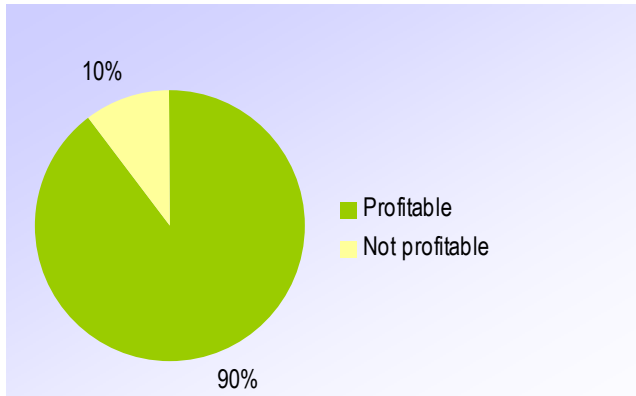


Diagram 3: profitability, Italy

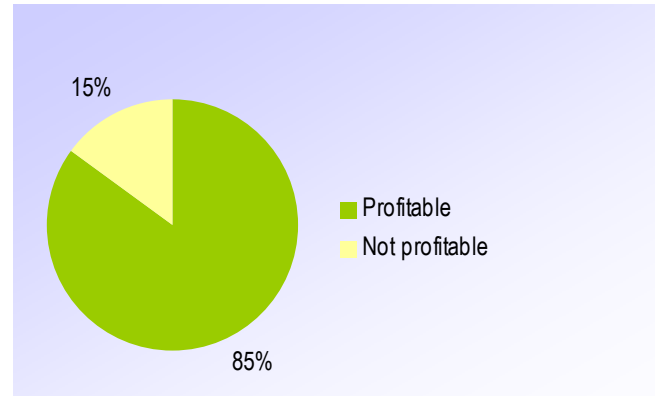


Diagram4: profitability, Japan

The samples are perfectly comparable for profitability too: 90% of Italian companies is profitable, as 85% of the Japanese ones.

Both the data are much higher if compared with the mean value of Italian and Japanese industry: this means that only the best companies want to confront themselves with other companies taking part to initiatives like *Monodzukuri Global Survey*, both in Italy and in Japan.

3.3 Conclusions

The analysis shows that the samples are comparable, even if they have very different sizes (474 companies for Japanese one and 51 for Italian one).

4 Survey results

In this chapter a comparison of the most interesting aspects of Italian and Japanese companies will be made.

4.1 Performance indicators

First of all the analysis will focus on the performance indicators used to evaluate operations results.

Diagram 5 shows the indicators marked as “high relevance” by the companies of the 2 samples².

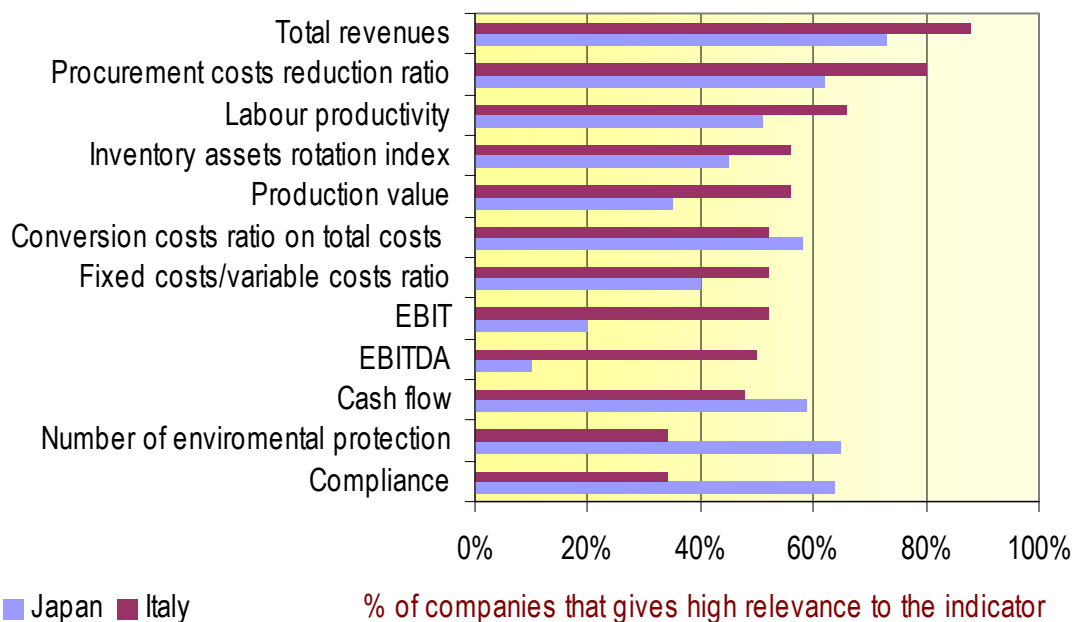


Diagram 5: most important performance indicators

The diagram shows that total revenues is the most important performance indicator for both Italian and Japanese companies. The second revenue indicator, production value, is used by a smaller number of Japanese companies, while it is quite popular in Italy.

The greatest difference is about margin indicators: EBIT (marked by 52% of Italian companies and 20% of Japanese ones) and EBITDA (50% of Italian and 10% of Japanese). This great interest in margins probably means that Italian companies are much more interested in short period results than Japanese ones.

On the other hand, Japanese companies give more importance to indicators like “compliance” and “number of environmental protection activities”, which was marked as relevant by 36% of Italian sample while more than 60% of the Japanese one marked them.

² Only the indicators marked as “high relevance” by more than 50% of the samples are listed in the diagram

The interest shown in Japan for environmental protection is undoubtedly linked to the sign, in 1997, of Kyoto protocol: between 2008 and 2012 all the countries who signed the protocol have to reduce their emission of 6 types of greenhouse gas by an average of 5% below the 1990 levels.

As for compliance, recently Japan has been invested by a number of scandals about companies who broke the laws. This lead to different consequences, from public excuses by top management to, in the worst cases, bankrupt. These events raised the interest for this theme, on which companies became much more sensitive.

On the other hand Italy, as Japan, signed the Kyoto protocol, and Parmalat is probably on of the greatest worldwide cases of bankrupt.

The fact that Japanese companies put “number of environmental protection initiatives” and “compliance” in the indicators panel they use to evaluate operations result shows that they give much more importance to long term results.

It is now interesting to analyse the course of these indicators in the last three years³:

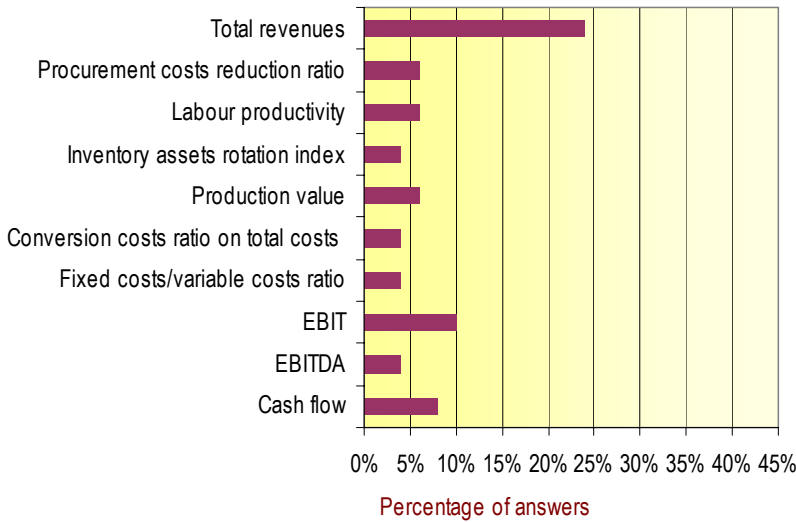
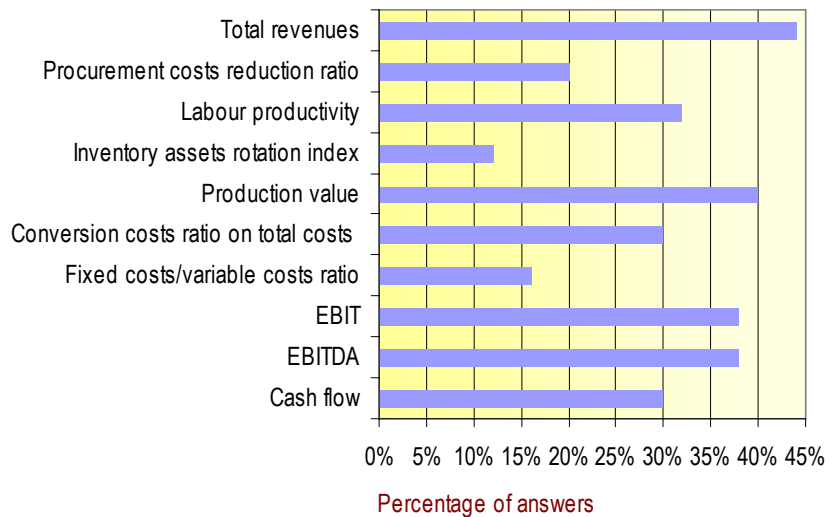


Diagram 6: Italy, course of the most important performance indicators

Diagram 7: Japan, course of the most important performance indicators



The two diagrams show a big difference in the result achieved in the last three years: *Diagram 6*, which summarize Italian situation, shows a strong growth of total revenues (24%), while all the other indicators are strongly increased by less than 10% of the companies.

The Japanese situation is completely different, with bigger percentages of companies that increase all the indicators.

To give an evident idea of the difference between the two samples, if we choose one of the indicators, the mean percentage of companies of the Italian sample that strongly improve it will be 8%, while the Japanese one will be 30%. This probably means that the improvement actions taken by Japanese companies have stronger results than the ones taken by Italian companies.

³ The diagrams report the percentage of company with an improvement >10% on the indicator in the last three years.

4.2 Production planning frequency

In this chapter the results concerning production planning will be analysed⁴.

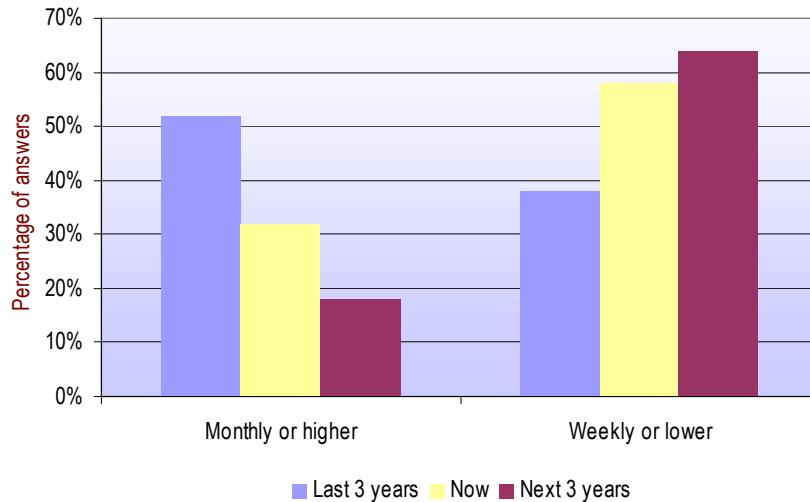
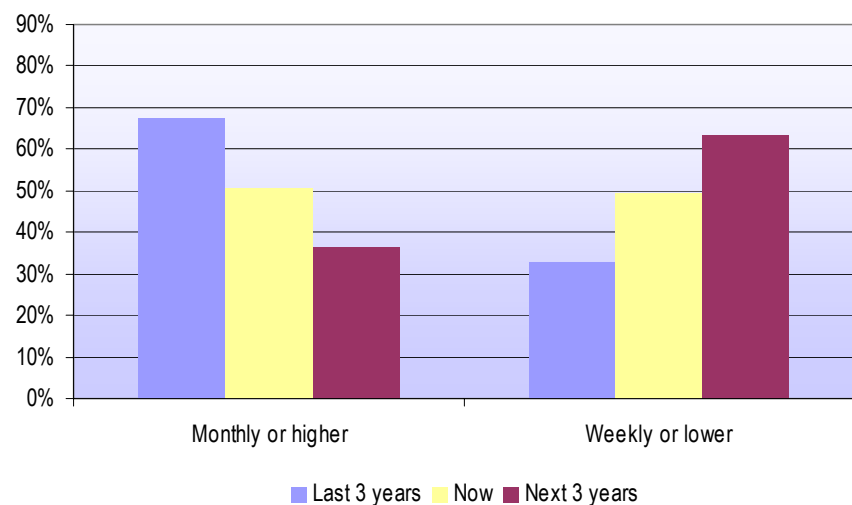


Diagram 8: production planning frequency, Italian sample

Diagram 9: production planning frequency, Japanese sample



Italian and Japanese samples show exactly the same trend: in the last three years production planning frequency increased in both the samples, shifting from monthly to weekly.

This trend will be confirmed in the next three years: only 18% of Italian companies and 36% of Japanese one will have a monthly frequency in the next three years (while, three years ago, it was used by 52% and 67%).

The increase of production planning frequency is a way to increase company's flexibility, in particular to face a variable demand. The fact that both Italian and Japanese samples show the same trend probably means that demand is changing in the same way both in Japan and Italy.

⁴ To make the analysis easier to understand, we grouped the alternatives given in the questionnaire in the "macro-groups": planning frequency monthly or higher and weekly or shorter

4.3 Scope of Operations Monodzukuri

Diagram 10 shows the functions that are considered part of Operations.

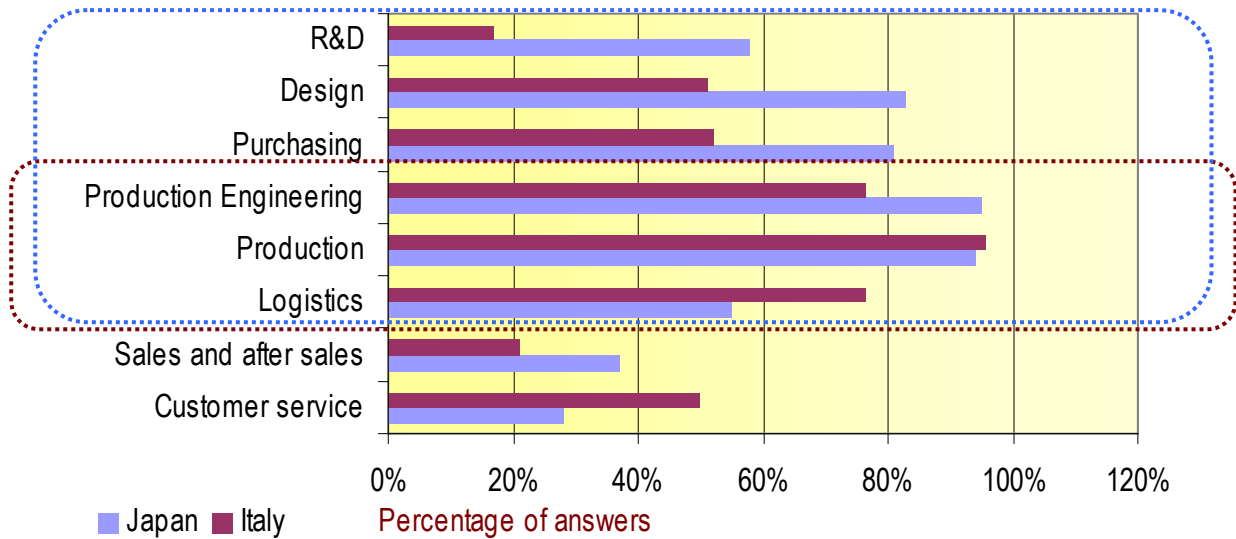


Diagram 10: scope of Operations – Monodzukuri

Diagram 10 shows the great difference between occidental idea of Operation and Japanese conception of Monodzukuri.

For Italian companies operations is something strictly connected with production (marked by 96% of the sample), sided by its two closest functions, production engineering (76%) and logistics (76%).

The percentage of companies that include other functions in operations is much lower, particularly if we look at R&D, which was marked only by 17% of Italian companies.

The situation of Japanese companies is completely different: there is a very strong integration of all the activities that precede production. For more than 50% of Japanese companies Monodzukuri ranges from R&D to logistics (even if logistics is not as integrated as in Italy).

This integration grants a strong competitive advantage: it grants to Japanese companies shorter development time for new products, because all the functions are part of development process from the beginning, making the application of *concurrent engineering*, VRP (*Variety Reduction Programs*) etc. possible.

Moreover, this level of integrations eliminates a number of problems in the last activities of productive process, like extra-costs and high non conformity levels when new products starts to be produced.

4.4 Critical aspects in Operations Monodzukuri

Diagram 11 shows the most important critical aspects in operations faced during the last three years⁵.

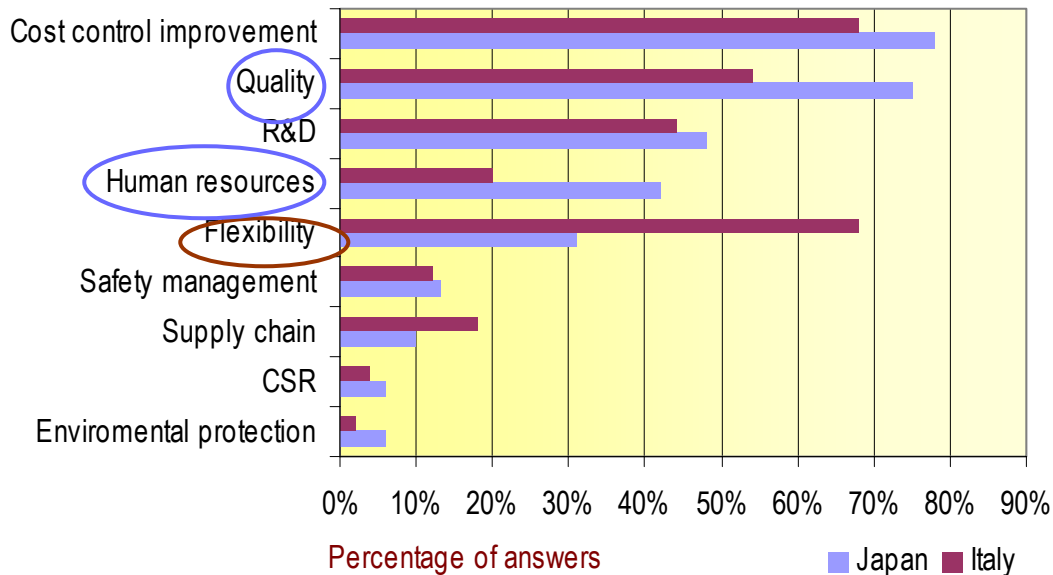


Diagram 11: critical aspects in Operations Monodzukuri, last three years

The diagram shows that, for both the samples, the most important critical aspect in the last three years has been cost control, marked by 68% of Italian companies and 78% of Japanese one.

There are three main differences in the diagram: quality, flexibility and human resources.

Lets start with flexibility: it has been marked as critical by 68% of Italian companies and only 31% of Japanese ones. This strong gap is probably due to the fact that many Japanese companies used “pull” productive strategies for many years, with strongly qualified and polyvalent operators: this allows them to react to market changes in a faster way than Italian companies.

Moreover, years of application of continuous improvement techniques on efficiency (TPM, *Kaizen* etc.) and on flexibility (SMED etc.) made Japanese plants intrinsically efficient and flexible.

The second difference is quality: it is marked as critical by 75% of Japanese companies and 54% of Italian ones. This data is even more interesting if we look at the results of 2003 edition of the survey (that, as already

⁵ Each company could mark up to three critical factor

said, was only held in Japan), where each company could mark only one critical aspects: 61% of the companies marked quality as main critical aspect, versus 21% that marked cost control and only 1% flexibility. We can say that quality is considered a “*condition sine qua non*” by Japanese companies, something that is absolutely necessary for the company, a qualifier without which is impossible to compete on the market. On the other hand Italian companies, even if they give a great importance to quality (which is the third critical aspect in the “ranking” shown in *Diagram 11*) don’t have this strong idea of quality as starting point of competition on the market..

The different commitment about quality can be also seen analysing the claim reduction achieved in the last three years: in Italy only 36% of the companies reduced the number of claims (reduction comprised in the range between 2% and 10%), while Japanese sample reported a mean improvement of 18% (that mean 6% each years, percentage that companies estimate to improve to 7% in the next three years).

The last relevant difference is human resources, marked as critical by 20% of Italian companies and 42% of Japanese ones. This difference is probably due to the fact that job relationship are more stable in Japan. Formation and career plans are made for all the positions inside the company, and managing human resources in the best way becomes a very important factor for company success.

Diagram 12 shows the changes in operations critical aspects expected for the next three years:

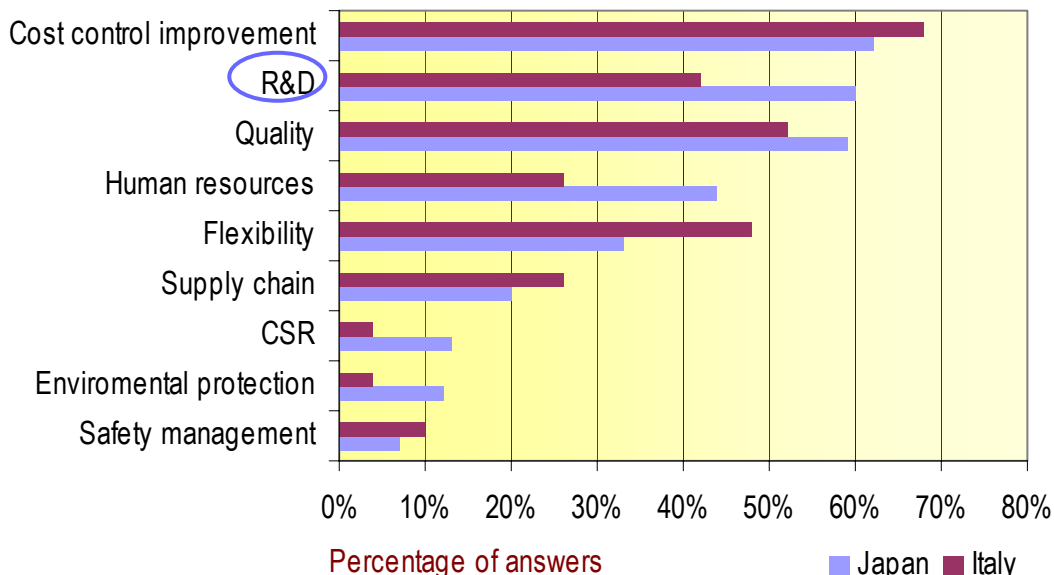


Diagram 12: critical aspects in Operations Monodzukuri, next three years

Diagram 12 shows that, in the next three years, cost control will remain the most important critical aspect for both Italian and Japanese samples.

We can notice a strong increase of interest in R&D in Japanese sample, marked by 60% of the companies, while it is stationary with 42% in Italian one.

Japanese companies declare a lessening of focalization in quality, which goes from 75% to 59%, a level that is similar to Italian one (52%, stationary).

Finally, there is a strong growing of interest for supply chain management, which increases from 10% to 20% in Japanese sample and from 18% to 26% in Italian sample.

The analysis will now focus on the four most important critical aspects (cost control, flexibility, quality and R&D) to understand the reason why they have been marked as critical and the kind of actions that companies will take in the next three years to face them.

4.4.1 Cost control

The first aspect analysed is cost control, which is the most important critical aspect for both the samples.

Diagram 13 shows the main critical aspects in cost control:

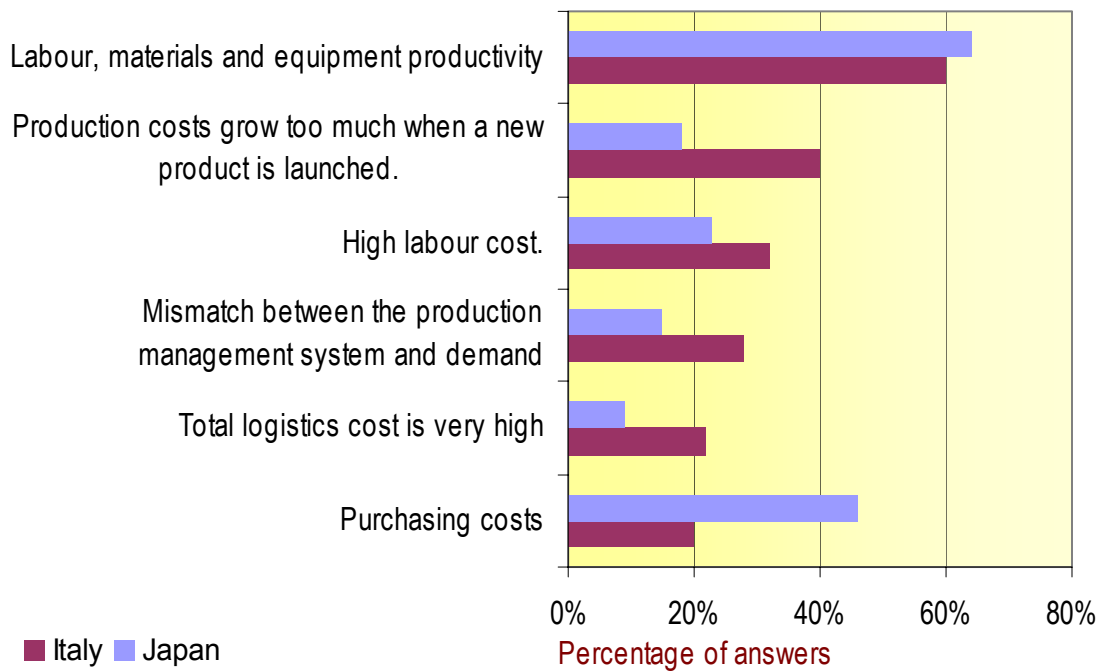


Diagram 13: cost control, most important critical aspects

The most important critical aspects in cost control is “labour materials and equipment productivity” for both the samples.

It is very interesting to study the second critical aspect: “production extra-cost when a new product is launched”. This critical aspect is marked by 40% of Italian companies and only 18% of Japanese ones: this is the proof that the integration of R&D in Monodzukuri of Japanese companies (and the use of techniques like *concurrent engineering, design to cost* etc.) grants them a competitive advantage on Italian ones.

The only aspect that seems more critical for Japanese companies is purchasing costs.

Diagram 14 shows the action that companies will take in the next three years to solve the critical aspects listed above:

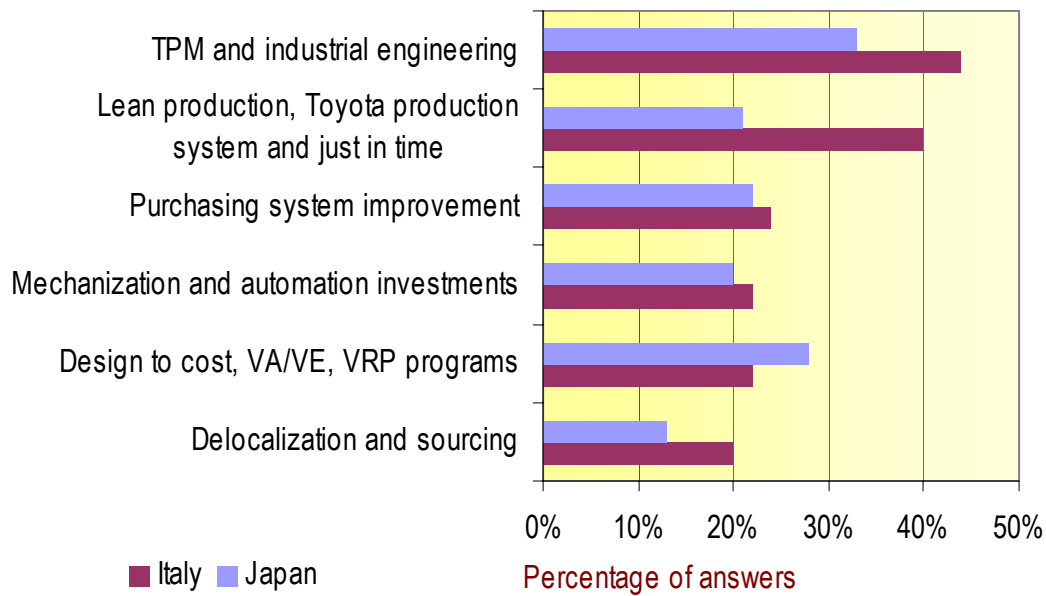


Diagram 14: cost control, main actions

As for actions, TPM (*Total Productive Maintenance*) and *industrial engineering* are the preferred ones both for Italian and Japanese sample.

The greatest difference is about lean production and Just in time: 40% of Italian companies want to adopt this kind of solutions, while only 21% of Japanese ones wants to. This is probably due to the fact that most of the Japanese companies are already doing this kind of actions, and now only have to control that they continue to work as planned.

There are not relevant differences for the other choices.

4.4.2 Flexibility

Let's analyse flexibility, which was the most important critical aspect for Italian companies in the last three years with cost control (68%), but which was marked only by 31% of Japanese ones.

The analysis will be done in the same way as in *paragraph 3.4.1*, showing first of all the most important critical aspects and then the actions that companies plan to do to solve them.

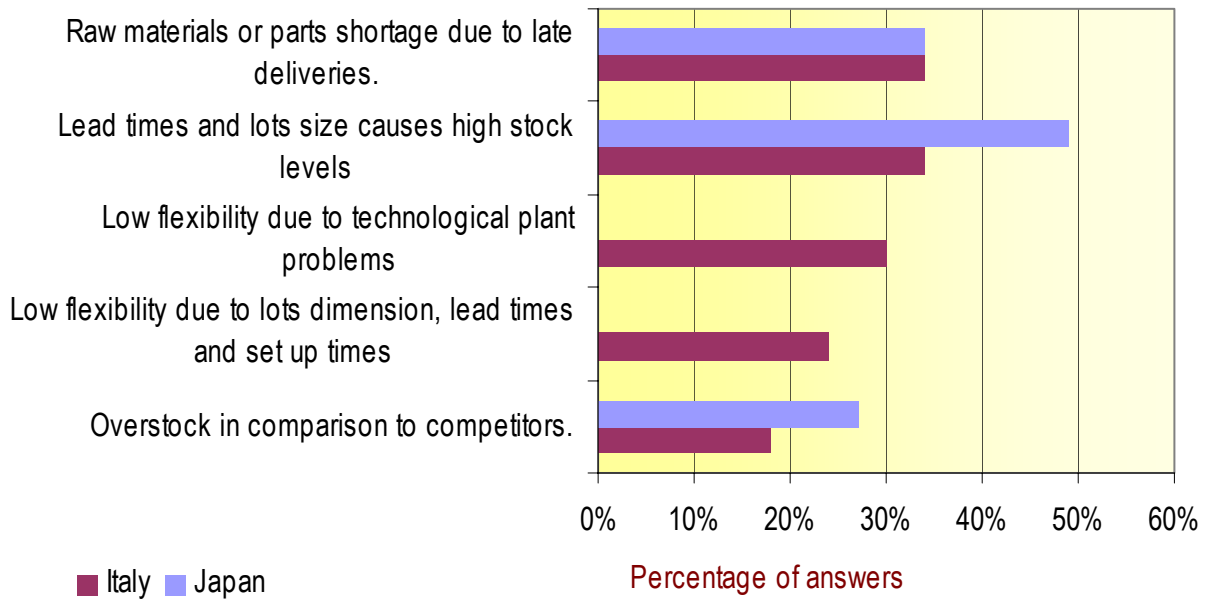


Diagram 15: flexibility, critical aspects

First of all it is important to say that this question was slightly different in Italian and Japanese questionnaire: in particular, some alternatives were added to Italian questionnaire (“low flexibility due to technological plant problems” and “low flexibility due to lots dimension, lead times and set up times”) to make the range of alternative wider and to have a better description of this critical aspect.

This difference, on the other hand, makes a comparison between the two samples less meaningful.

As for actions, lets see *Diagram 16*:

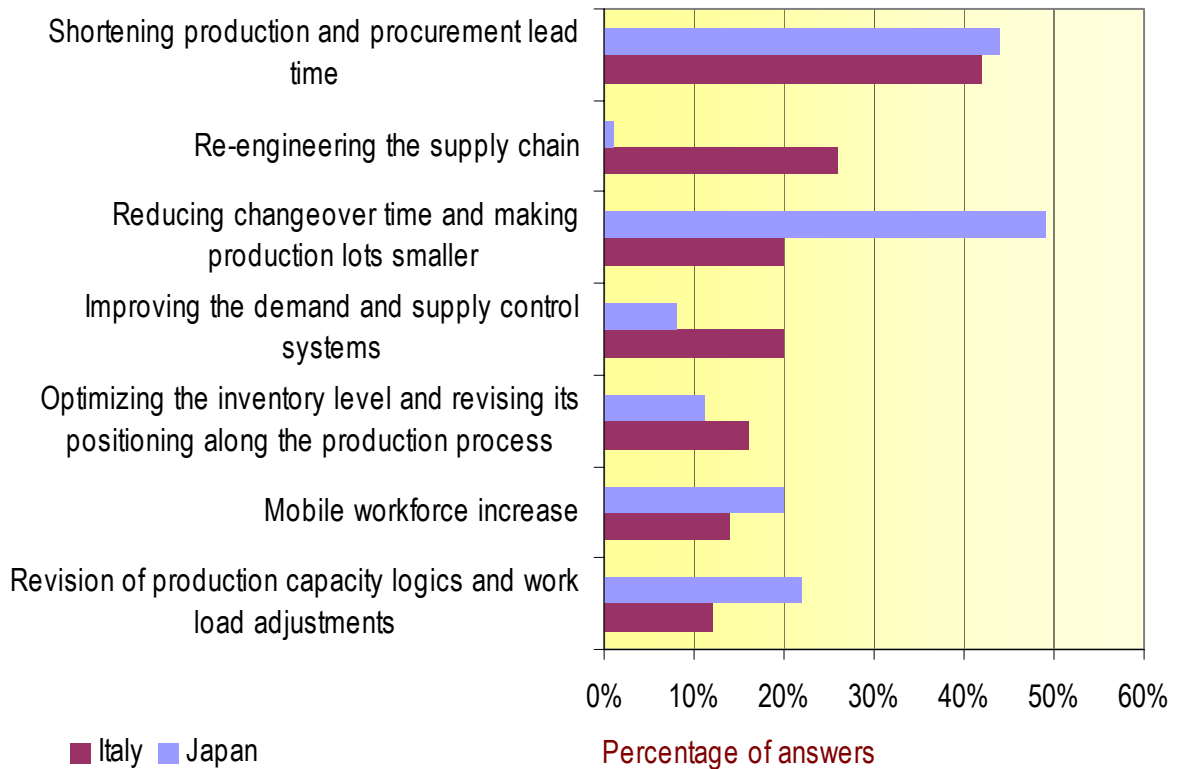


Diagram 16: flexibility, main actions

Diagram 16 shows two main differences between Italian and Japanese sample.

The first one is about the reduction of setup times, changeover times and lot dimension, marked by 49% of Japanese companies and only by 20% of Italian ones. For the Japanese sample we can notice that the percentage is the same of the one of the critical aspect “lead times and lot size causes high stock levels”: the companies that marked that choice are going to solve it with this action.

More than 40% of both samples want to reduce procurement and production lead times too to solve this problem.

The second difference is about supply chain: 26% of Italian companies want to re-engineer their supply chain, while only 1% of Japanese one marked this action.

The greater attention shown by Italian companies to supply chain management shows the different way that the two samples follow to manage improvement: European approach is “systemic”: it analyses all company’s problems together trying to get improvements in all fields. Italian companies try to improve supply chain performances before completely solving their internal problems (production, ingegnerization etc.).

On the other hand Japanese approach is “step by step”: it starts from a strong focus on production, and enlarges its scope of analysis once all internal problems have been solved. Japanese companies focalise all

their resources on internal processes improvement, and enlarge their improvement plans to supply chain only when internal processes are optimized.

Both european and japanese approaches have their force and weakness points, and there is not a “better” approach. Each company should study its situation, and then decide which of the two approaches is better for itself.

4.4.3 Quality

The analysis will now focus on quality, factor that, in the last three years, has been marked as critical by 75% of Japanese companies and 54% of Italian ones.

Let's start with critical factors:

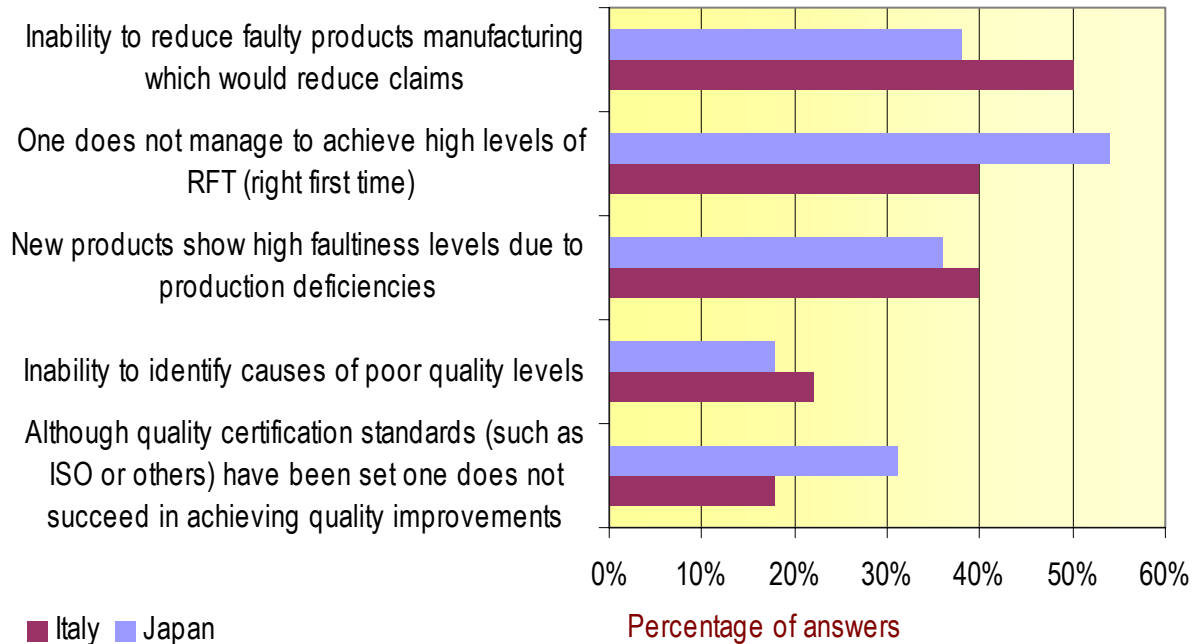


Diagram 17: quality, critical aspects

There are not great differences in the two samples.

The most relevant difference is about the two first critical aspects, which have inverted order of relevance for Italian and Japanese companies: for Italians the first critical aspect is “inability to reduce the number of claims due to faulty products”, while for Japanese is “difficulty to have high percentages of right first time”.

This difference probably means that Japanese companies have better control systems at the end of their productive process, which allow them to identify faulty products and re-manufacture them before they arrive to final customer.

As for the actions:

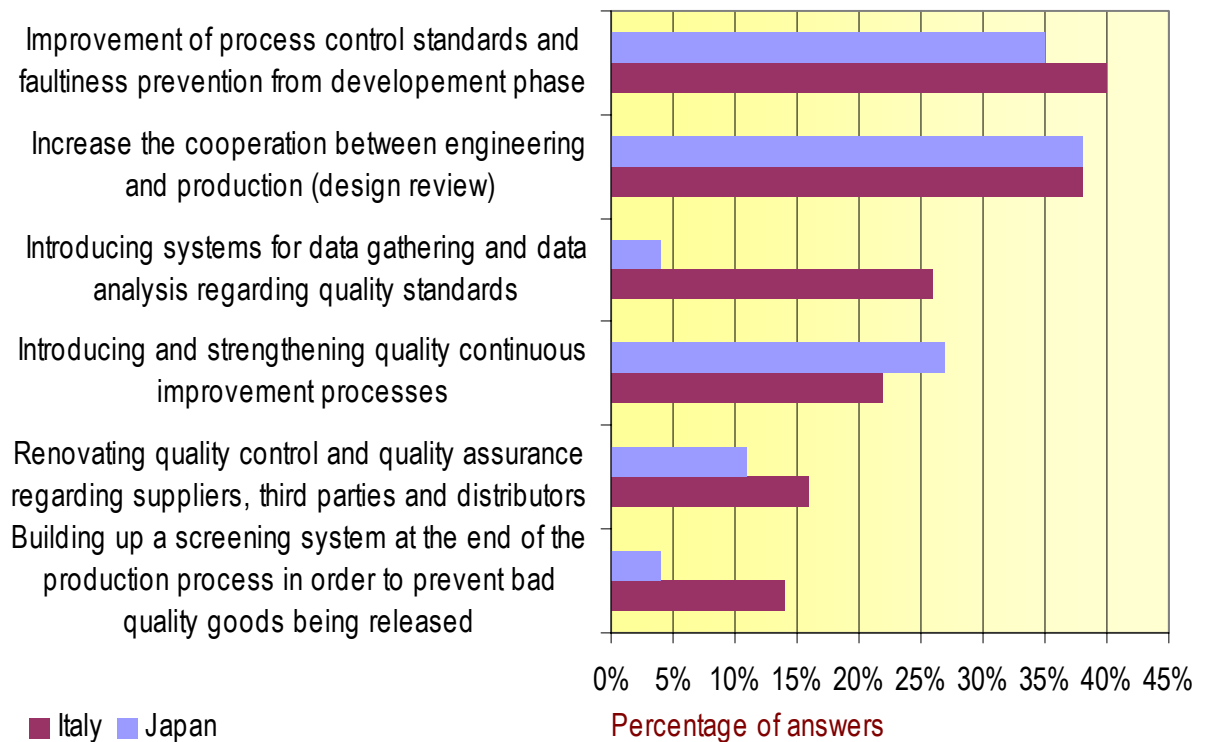


Diagram 18: quality, main actions

As for actions, it is very interesting to notice that the first two are strictly connected with a better integration of R&D: companies want to “improve process control standards and faultiness prevention from development phase” and “increase the cooperation between engineering and production with design review techniques”. There is a major difference about the introduction of systems for data gathering and analysis, selected by 26% of Italian companies and only 4% of Japanese ones. This confirms the hypothesis that Japanese companies already have these kind of systems, so they do not need to take actions in this direction.

4.4.4 R&D

Finally R&D will be analysed.

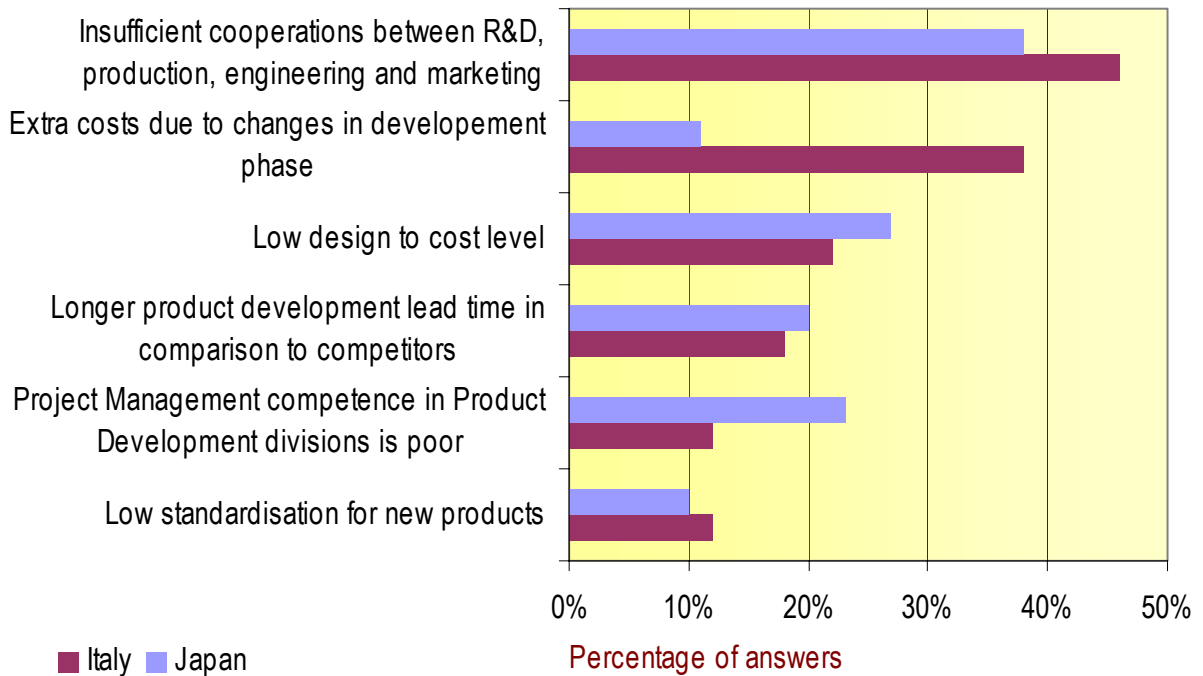


Diagram 19: R&D, main critical aspects

The most important critical factor in R&D is, for both the samples, the low cooperation with operations functions, marked by 38% of Japanese companies and 46% of Italian ones. This problem, that we already seen many times in this report, is probably one of the most important in operations management.

The second critical aspect, for Italian sample, is strictly connected with the first one: extra costs due to changes in development phase. This happens because there's not cooperation between functions. For example, research and development knows about constrains when the project is already on an advanced state, creating delays in developing times and non prevented production's extra costs.

As for actions:

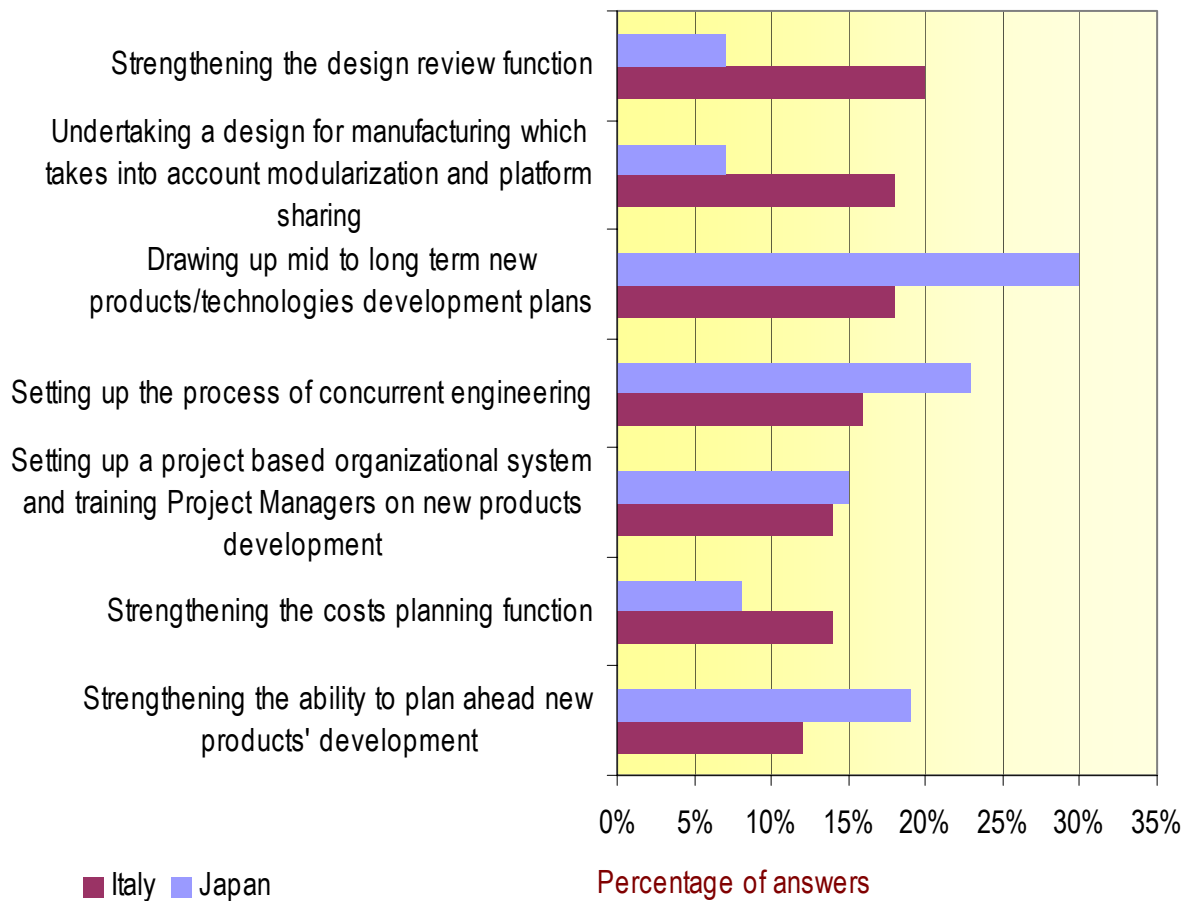


Diagram 20: R&D, main actions

The answers given by the two samples are completely different.

For Italian companies the first answer is the use of design review techniques, sided by modularization for new products (the aim of these actions is, mainly, a productive costs reduction).

Japanese companies focused on more “strategic” solutions: “drawing up middle/long term product/technologies development plans” and “setting up the process of concurrent engineering”.

5 Conclusions

This chapter will summarize the most important aspects of the comparison between Italian and Japanese samples.

The first important aspect is the **return to basics** of operations management: **cost control, quality and flexibility**.

As for **cost control**, it was the first critical aspect in operation in the last three years for both the samples, and it will be for the next three too. The importance given to cost control can be seen analysing the result obtained in QCD performances: cost reduction is the performance where Italian companies obtained the best results, and Japanese companies had very good results too on that performance (even if they had better ones on claims reduction).

The focus on costs, particularly in Italy, can be seen in the interest for techniques like TPM, lean production and industrial engineering, that grant improvements in company's efficiency, lowering the wastes and, so, costs.

Quality is seen as a qualifier by Japanese companies, that in 2003 survey's edition considered it the most important critical aspect in operations, while today it is the second one and will become, in the next three years, the third. In Italy companies give great importance to this theme too, but quality is not as important as cost control.

The different idea of quality is confirmed by the result obtained in claim reduction in the last three years: Japanese companies lowered the number of claims by 18% in the last 3 years (6% each single year), and they plan to increase this percentage to 21% in the next three years.

On the other hand, only 36% of Italian companies, in the last three years, registered an improvement greater than 2% on this performance.

This difference is very important, in particular if we look at the results obtained by Italian best performer⁶. The greatest difference between best performer and the rest off the sample is their focus on quality: quality is one of the most important factors for company's success, and Italian companies are not as good as Japanese ones in this field.

The third relevant aspect is **flexibility in demand response**. This aspect is particularly critical for Italian companies, that identified it as the most important critical factor in operations in the last three years.

⁶ Best performer is a sub-group of elite companies in the Italian sample

The competitive contest in which companies compete is characterized by a growing demand variability and by the request of innovation and new products: to satisfy these request, a great level of productive flexibility is required.

For Japanese companies, flexibility is not as critical as for Italian ones. This is probably due to the fact that Japanese companies, during the last years, put a great effort in continuous improvement and optimizations techniques (on setup times, changeover times, lots dimension and machine's efficiency). All this efforts, now, grant them a great structural flexibility on productive mix.

The last aspect shown by the research is the importance of a strong **integration between R&D and production**, aimed to reduce production costs and new products time to market.

Japanese companies seem to be much more integrated than Italian ones: 58% of them include R&D in operations, while only 18% of Italian ones do it.

A better integration of development process could solve many of the problems regarding costs and quality that troubles Italian companies. It is finally important to notice that Japanese companies, which are very integrated, are moving to deeper levels of integration.

We would finally thank all the people and the companies that cooperated with this survey.