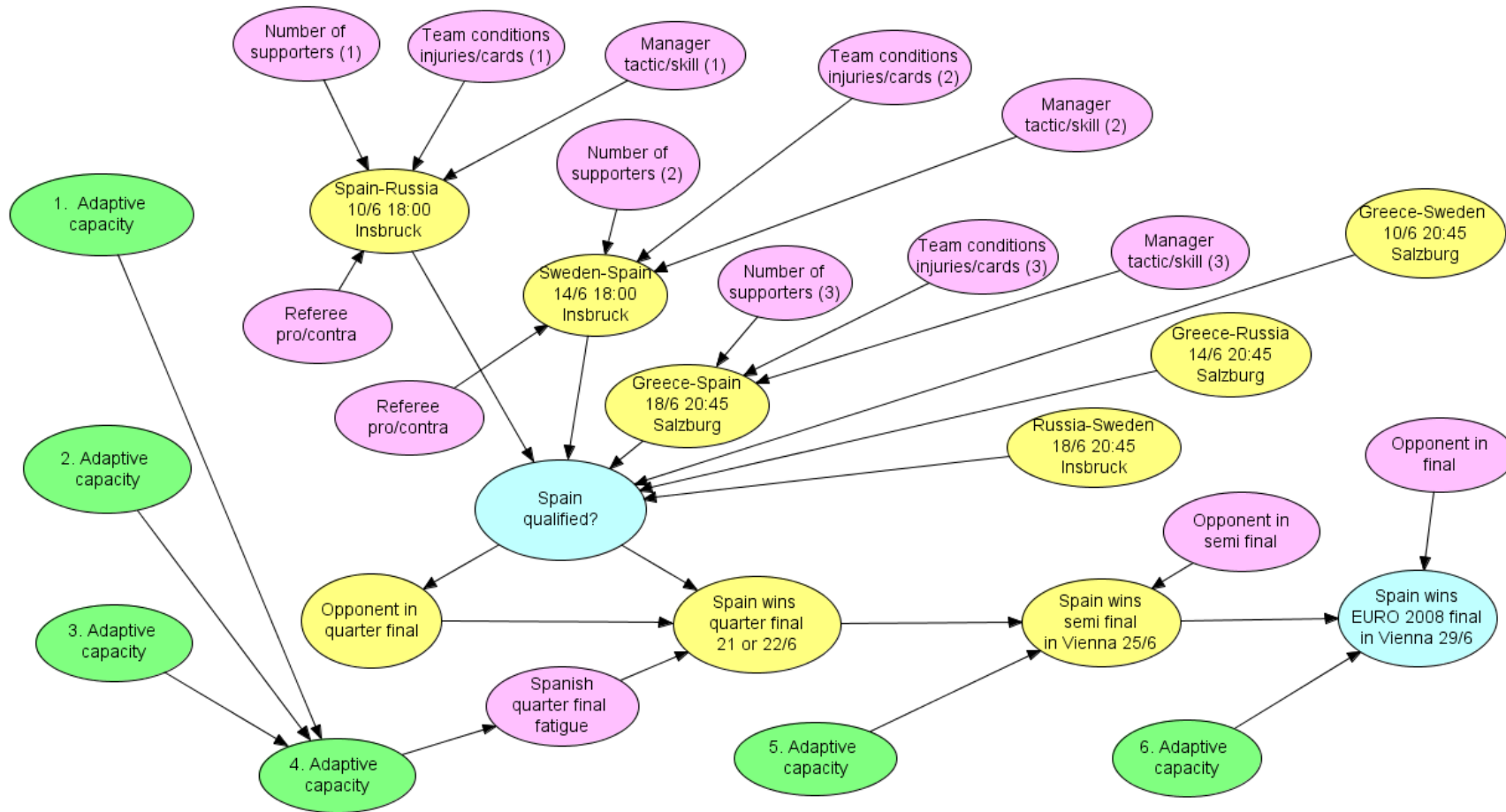


Bayesian belief network for Euro 2008

Variables and links in network describing Spain's chances for becoming champions

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Behind the EURO 2008 Bayesian belief network

A Bayesian belief network, also called a Bayesian network (BN), is a type of decision support system based on probability theory which implements Bayes' rule of probability. This rule shows mathematically how existing beliefs can be modified with the input of new evidence.

BNs organise the body of knowledge in any given area by mapping out cause-and-effect relationships among key variables and encoding them with numbers that represent the extent to which one variable is likely to affect another. Factors, associations and probabilities can be adjusted and validated and BNs are powerful for integrating data and knowledge from different sources and domains, e.g. domain models and are also capable of handling uncertain information in a practical and understandable way.

BNs have gained a reputation of being powerful techniques for modelling complex problems involving uncertain knowledge and impacts of causes. Ideally, BNs are a technique that is especially helpful when there is a scarcity and uncertainty in the data used in making the decision and the factors are interlinked, all of which makes the problem highly complex. BNs are especially helpful when assessments of a broad multiple spectrum of indicators are required e.g. economic, social, hydrological and ecological. In the case of EURO 2008 the goal is to become the champions, so here the example rather illustrate a subsequent series of action situations, where the network can illustrate the most important action situations to focus on and the most sensitive variables influencing a successful achievement of the overall goal e.g. an attempt to learn "from the future", sliced into action situations like the three matches in the first round, followed by quarter final, semi final and final.

Another way of zonation painting

Even though a BN has nothing to do with zonation painting and nothing to do with modelling, the principles for zonation painting is still valid. This means that a BN is integrating all variables into a graphical model, and the conditional probability tables, so to speak, modulate the entire knowledge space into a relational approach for uncertainty reasoning. There are focus points also, e.g. in this case the important quarterfinal against France, Italy, Netherlands or Romania, where Spain traditionally have experienced quarter final fatigue, leaving the tournament when beaten in previous quarter finals.

The most sensitive variable in fact is this 'quarter final fatigue'. Another sensitive variable is the opponent in the quarter final where Italy doesn't seem to be the best one to meet. When a match is finalised, the uncertainty distribution (win, draw or loose) will switch into an evident state, from the previous probability distribution. This will have a knock on effect on all other variables, and allow updating of the probability for Spain winning the EURO 2008.

The beauty of Bayesian belief network that they can help managers and stakeholders to explore different uncertainties and explicitly represent those into a graphical model. Hereby uncertainty reasoning can begin.

Negative capability and adaptive capacity

When a team can not adapt to the situation, it will not be very successful in EURO 2008. Adaptive management is thus required for having success, and adaptive management means the ability to proactively learn about the uncertainties which emerge between

and during matches. To address such a stressful situation require optimal strategies and tactics.

Negative capability was defined by Keats as a state in which a person (here a soccer team) “*is capable of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason*”. This capacity allows actors to live with and to tolerate ambiguity and paradox, half knowledge, anxiety and fear. This is needed for new thoughts or perceptions to develop, and needed when matches do not follow the prescribed expectations and strategies, e.g. when the other team scores a contra goal, which was not planned for. In the BN this ability of a team to learn and to adapt to challenges and profound change has been incorporated by introducing a sequence of monitoring variables, which are evaluated after each match. Updating these result in a BN with feedback. The string of variables can, if Spain shows adaptive capacity in the first round matches, knock on and influence the “quarter final fatigue” variable, and hereby impact Spain’s chances in the quarter final and eventually semi final and final.

Initial probabilities and importance of adaptive capacity (June 6)

Before the tournament Spain has 8.5 % probability of winning the EURO 2008, and 30 % chance of qualifying for the semi final. If we assume that the adaptive capacity is “high” after the first three matches, then Spain’s chances of winning the EURO 2008 will increase to 10,3 %, and with a chance of qualifying for the semi final of 36,5 %. But if Spain show low adaptive capacity after the first three matches, then Spain’s chances of winning EURO 2008 is reduced to 6,8 % with a 24,2 % chance of qualifying to semi final.

Everybody know the awful Spanish national team history in previous Euro and World Cup tournaments:

- 1986: Spain lost on penalties in the quarters to Belgium
- 1994: Lost to Italy in quarters
- 2002: Lost to South Korea in quarters (referee against)
- 2006 lost in the round before quarters to England

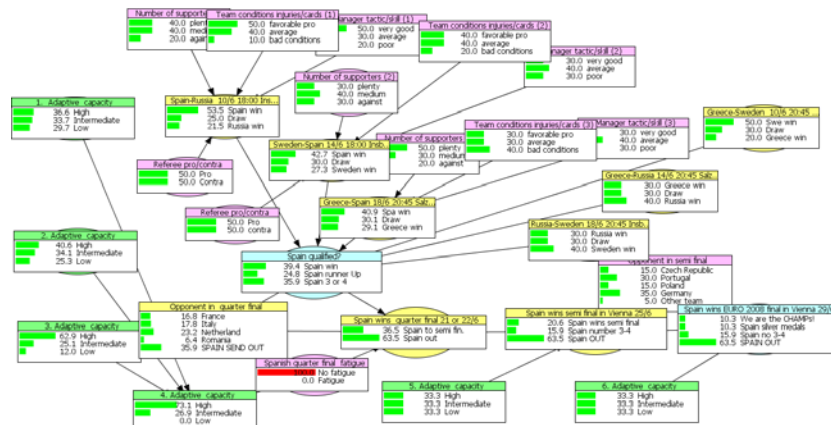
As stated by the Guardian journalist Sid Lowe: “*That history weighs on Spain. Perhaps that is why, some say, they lack conviction; perhaps they lacked edge, that intangible quality of being able to win against all odds. Or perhaps they were never as good as they thought they were – which might just mean, more importantly, that perhaps this time they are. Perhaps this time there really are differences*”. (Guardian, 5 June 2008). But perhaps we will not experience this quarter final fatigue this year. Perhaps the adaptive capacity will be high, and that Spain can manage uncertainty and complexity this time.

Sid Lowe suggests the following arguments for this new Spanish era in soccer:

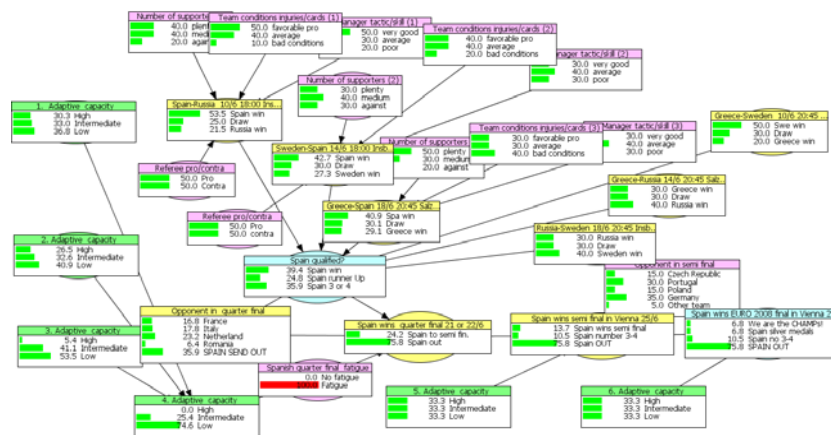
- For the first time Spain have players playing around, adapting to a different styles, demands, and referees
- There is little internal conflict, unlike many previous Euro’s and World Cup’s
- The talent is there, the midfield sections is strong with Cesc Fabregas, Andrés Iniesta, Xavi Hernandez, Xabi Alonso, Marcos Senna and Santi Cazorla
- There is a talent for scoring goals among the forwards: Fernando Torres and Dani Guiza (both have scored 27 league goals). In addition David Villa, despite being injured a large part of the season, scored 18 league goals.

But, we must realise that there are also weaknesses in the Spanish defence. Too many cooks on the midfield, may also be a problem,

by not providing enough room for the brilliant Fabregas to do his visionary passes, full of creativity and unpredictable power.



Probabilities of EURO 2008 with evidence of quarter final 'No fatigue' (in this case Spains chances for winning EURO 2008 is 10,3 % and chance for winning quarter final is 36,5 %)



Probabilities of EURO 2008 with evidence of quarter final 'Fatigue' (in this case Spains chances of winning EURO 2008 final is 6,8 % and chance for winning quarter final is 24,2 %)

Updated probabilities after first round and Spain's 4-1 victory over Russia

Three goals by David Villa and one by Cesc Fabregas against Russia did increase Spain's chances of becoming champion from 8,5 % to 11,1 %. The Bayesian belief network tells us that the referee was pro Spain evaluated by a 53,8 % probability (a parent variable to the match Spain-Russia), that there was a 43 % chance of supporters being "plenty", which seem to be fair (another parent variable to the first match), that the team conditions showed a 53 % probability of being "favourable pro" (another parent variable). Finally, the tactical skills of the Spanish manager showed a probability of being very good of 54,2%.

Based on the full match and Spain come back after the goal by Russia, I decided to enter a state of the 'adaptive capacity' monitoring variable with the evidence of 'high'. This was one of the most convincing victories by any team in the first round because Russia is not a weak team. Finally, I entered the result of the match between Sweden and Greece, where Sweden got a 2-0 victory, e.g. with the game Sweden-Greece in the state of 'Sweden win'. With these evidences entered the probability of Spain to qualify for the semi final has increased from the initial 30 % probability to a 39 % probability. The next match between Sweden and Spain will be quite important, because Spain can with a victory over Sweden qualify for the quarter final.

Intermezzo with the primacy of uncertainty before the match Spain - Sweden

Midway in the first round, and with the Swedish supporters travelling like vikings from the north to the south of Europe in trains, busses, cars and airplanes and toward the arena of tonight's match against Spain, let me try to reflect a little upon the current

situation and factors influencing who will win the tournament. First, let us remember the apples falling from the tree accelerated downwards (by gravity) toward the “mental model” of Newton. Newton was sitting below the tree dreaming of linearity, instrumental rationality and perfect objective systems, following the laws of physics. He must have been groggy, and did not think enough about non-linear systems, emergent complexity and the fact that epistemological knowledge is situated and sometimes tacit.

We have now learned that Euro 2008 soccer, and EU politics and many other systems, rarely follows the primacy of objectivity. With the help by Habermas we earlier stuck to the primacy of intersubjectivity and communicative rationality as possible ways to extend our world views for enhancing objectivity. But the clear cool NO from the Irish people to the Lisbon treaty show us that intersubjectivity is not longer enough, we are moving into the “doubt society”. In this new place we will need to go deeper into a tripple loop learning process, directing focus to the primacy of transsubjectivity, and understanding of the meaning of people and teams development of a more authentic or mature self (something needed for many teams right now), compared to current insufficient team self.

Euro 2008 seems right now governed by transsubjectivity and ‘living presence’ (Husserl). The battle is very much about a clash between the old self and the emergent new Self. We know that the soccer ball follow Newton’s physical laws of linearity, described by the primacy of objectivity. But we also have seen that the result of matches are very much influenced by the action arena, with two teams battling in group and intergroup behavior fighting for goals in arenas of communications and artistic movements. Sometimes these action arenas are strongly influenced by the interventions of referees. Sometimes supporters

enter’s the battle field like in a qualifying match between Sweden and Denmark last year. But important here is, that these communicative arenas not only are ruled by the primacies of objectivity and intersubjectivity, and the rules prescribed by UEFA for making decisions. They are also influenced by the mental models or inner worlds of individuals and teams.

On our flat screens we have seen with teams like Italy, France, Germany having lost a game, that understanding these unpredictable dysfunctional events, we need to focus our attention toward the team Self (inner world of teams and individual players), which is governed by the primacy of transsubjectivity. It seems like many teams are struggling very much with the challenge of replacing an old and less competitive team self and playing style, regime and strategy, like Italy with its old men from Milan, into something a new and more authentic, more mature, entertaining and more competitive adaptive style.

So far we have noticed that teams like Portugal, Croatia and Netherland have demonstrated an offensive competitive team Self also with the ability to “learn from the future as it emerges”, as Scharmer poetically has coined it (Theory-U). But for other teams like Germany, the learning curve suddenly became all too steep. The German romantic self for a moment became tired and plagued with fatigue, and the German team didn’t notice the blind spots and the uncertainties. That is why Croatia was able to beat Germany. So, I suggest a fourth primacy, the primacy of uncertainty, which is the purposefully concern and attention toward the uncertainties of the next match. For exploring such uncertainties we need tools like Bayesian belief networks helpful for triple loop learning, and letting objectivity, intersubjectivity, transsubjectivity and uncertainty come together. I will demonstrate now with the example of the next match between Spain and Sweden who uncertainties are evaluated with the BN.

Spain still has a good chance to become the fourth team who demonstrate the ability to work with all four primacies. The coach Aragones have some difficulties, the Swedish team supported by numerous vikings are coming to town, and what will happen? Lets first have a look at the next “time-slice”. The next “time sliced” action arena will be on Saturday evening June 14, 18:00-20:00 central Europe time. If Spain win against Sweeden, the quater final could become a match between Spain and Romania, and the chances for reaching the semi final in this case would be well above 50 %. However, if Spain loose against Sweeden, Spain will most probably meet Netherland in the quarter final (if Spain qualify for the quarter final which not is certain at all), which leaves Spain with chances for reaching the semi final only around 25 %. Therefore, the real challenge for Spain may not be to master the outer battlefield in Insbruck tonight. Instead managing also the inner battlefield and the clash between old team self and new team Self is needed. This may explain why Aragones eventually will start without Cesc Fabregas among the starting eleven against the “blue yellow Swedish Vikings”.

Spains chances increased to 15 % after victory over Sweden

After the second round Spain now has qualified for the quarter final, and will play against France, Italy or Rumania. This fact, and assuming that Rumania (40%) is the most likely opposing team, since Netherland now has qualified and is expected to rest most of their best players, letting other players enter the tournament to get them involved also. After having entered these evidences, shown with blue bars in the Figure above we can now use the Bayesian belief network and interferences to evaluate the updated chances for Spain in the tournament. Again the adaptive capacity of Spain was high in the last match, so this has been entered as monitoring data, since manager Aragones and the

rather young team demonstrated patience and skill to score the important goal to 2-1 in 92th minute by David Villa. With these results, and the match result of 1-0 (Russia did beat Greece), the chance for Spain for becoming champions now has increased significantly to 14,9 %, and with a chance of 54,7 % for Spain to win the quarter final.

Chances after match between France and Italy

After the match between France and Italy the quarterfinal will be between Italy and Spain. This is the worst case scenario for Spain. Even though Pirlo and Gatusso will be out due to yellow cards, the chances for Spain, now has been decreased significantly to a chance of becoming champions now around 12,6 %, and with a chance of qualifying for the semi final, (most probable against Portugal or Germany) with an updated chance of 44,5 %. However, much will depend on the adaptive capacity collected after the match against Greece. If Spain again shows high adaptive capacity once again, the Bayesian belief network give them a 50 – 50 % chance for beating Italy, and with a chance of becoming champions of 13,6 %. In opposite, if adaptive capacity is low after the match against Greece, then the chance will be reduced significantly to only a 40 % chance of beating Italy, and with a chance of becoming champions of only 10,9 %. To conclude, it does not look likely that Spain will overcome its historic quarter final fatigue. This Euro 2008 looks like the previous 38 years of Euros and World Cups. If evaluated based on entertaining soccer, Germany and Italy, do not deserve to qualify for a quarter final this year, but if evaluated based on tactics and will, we have deserved to qualify for the next round. But learning from the past no longer is enough, we need to realise that we also has to learn from the future as it emerges. And as seen many times before, emergent complexity probably will turn Italy and Germany into something very different from the steady

way of playing without much creativity and skill, as we have seen from these teams so far. But the quarter finals will soon tell us if (once again) the ugly duck teams from Germany and Italy will turn into beautiful swans. In that case, Spain still have a good chance. Because without the creative Pirlo, and with Löw (like Morten Olsen in the qualifying) sitting in the box with no contact to his players, both Italy and Germany will experience problems, which in the end could ease the route for Spain to the final, and in the end turn them into the singing team, singing “we are the champions”. But why can we interpret the chances?

Updated probabilities after first round

After today’s match against Greece (2-1 to Spain) the Bayesian belief network has been updated. Before the clash in the quarter against Italy, I have switched the monitoring variable into the state of ‘high adaptive capacity’. This evidence is supported by the successful game against Greece, with a totally new team, with goals by de la Red and Guiza, and in general a very well functioning B-team, which when the tournament gets tuff with yellow cards, red cards, playes becoming injured etc. will be of high value for providing a road to the final.

Furthermore, I have updated the states of the possible opponents in the semi final and added a similar variable for opponents in the Final (I fact the BN had a minor error, because the possible opponents in the semi final is either Netherland or Russia). In the final the opponent can be Germany, Portugal, Croatia or Turkey. In order to come up with a best estimate I have therefore updated the state of the opponent variable, in a Bayesian belief network the flexibility of the tool allow rapid reassessments of this type.

I also decided to enter evidence for adaptive capacity for semi final and final. Furthermore, I entered Italy as opponent in the

quarter. And Portugal having a slightly higher probability of being the opponent in the semi final (compared to Germany due to the escapades of the German coach, Löw).

So the final assessment of Spain’s chances before the final quarter, semi final and final is as follows (see Figure above):

- Chance of becoming champion: 14,1 %
- Chance of qualifying for final: 26,6 %
- Chance of beating Italy in semi final: 50 %

All the teams having qualified to quarter final are strong teams. Anybody can win, but so far Spain has done a fine job, and enter the final matches will high adaptive capacity. This may be very important in the end. Lets see!

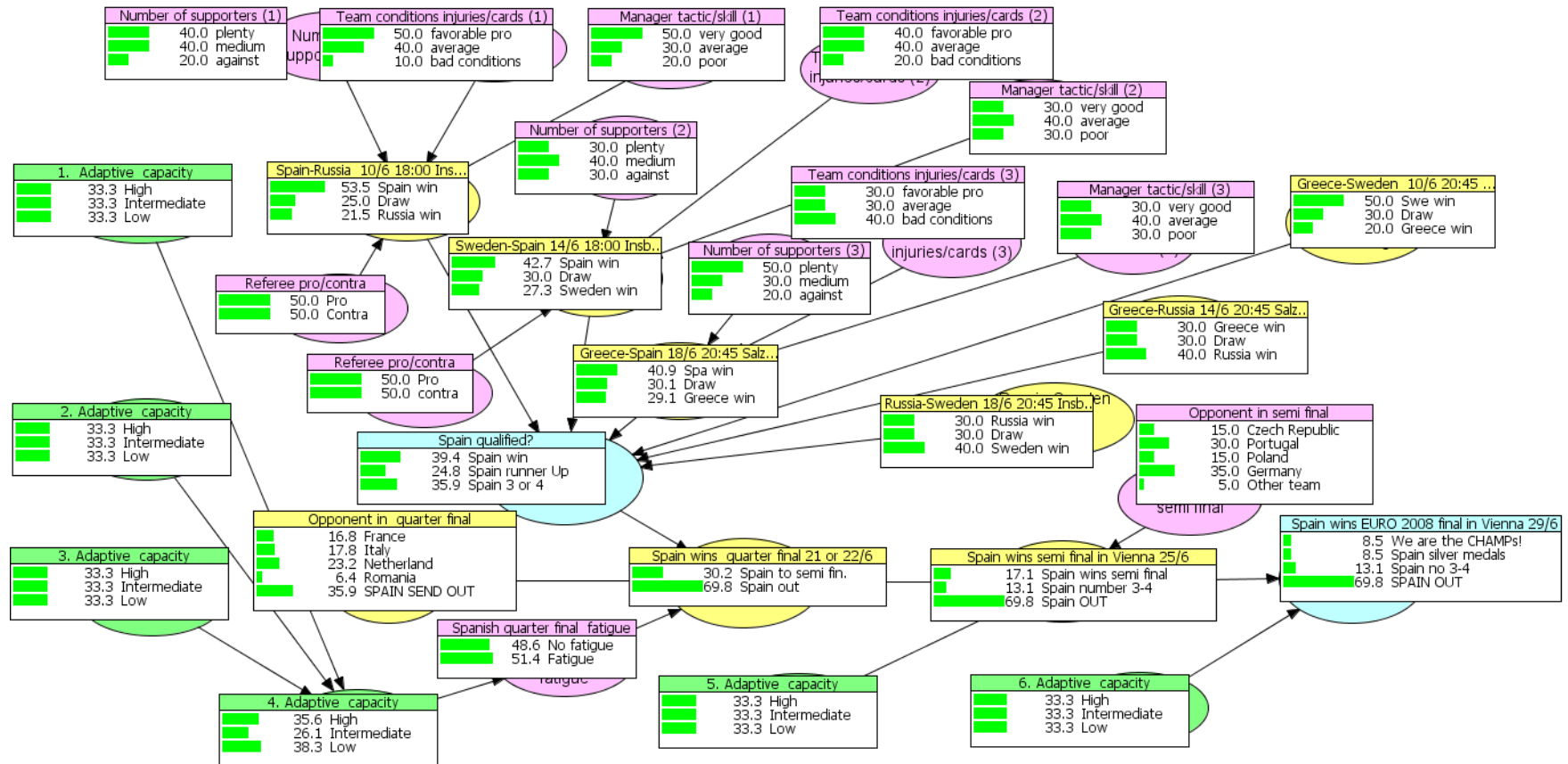
Good luck to Spain, you will need it!

Chances significantly increased before the semi final

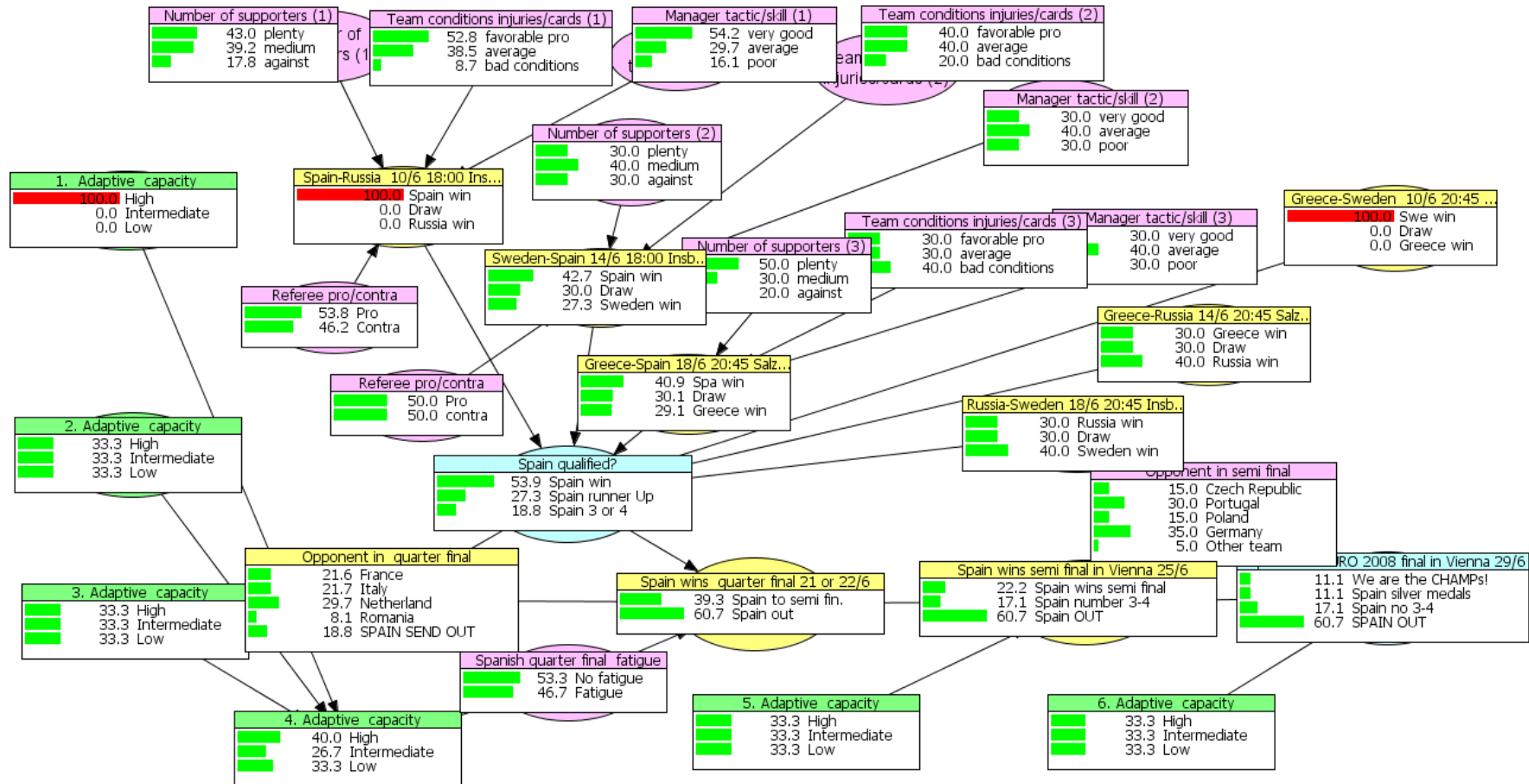
After the “de Natalization” of Italy, the chances for Spains looks much better. Chance for becoming champions is now around 30 %, which a chance of beating Russia in the semi final of 58 %. After the fifty-fifty chances against Italy, in the bottom of the learning cycle, Spain can now go all the way. Spain again tonight showed brilliant ‘adaptive capacity’, and did beat Italy, it was Spain in “italics”, after many, many years and problems with June 22. What a maturity for such a young team, to win this time, to have the patience! And what a great joy for us, supporters of offensive soccer. It seams like this Euro has something different, compared to previous Euro’s, it is the beginning of a new beginning, old boys have to leave the scene now, let the young boys play, and lets enjoy offensive soccer, as played by Germany (when they are best), by Turkey (when they need to), by Russia and by Spain.

Probabilities as they developed through the tournament.

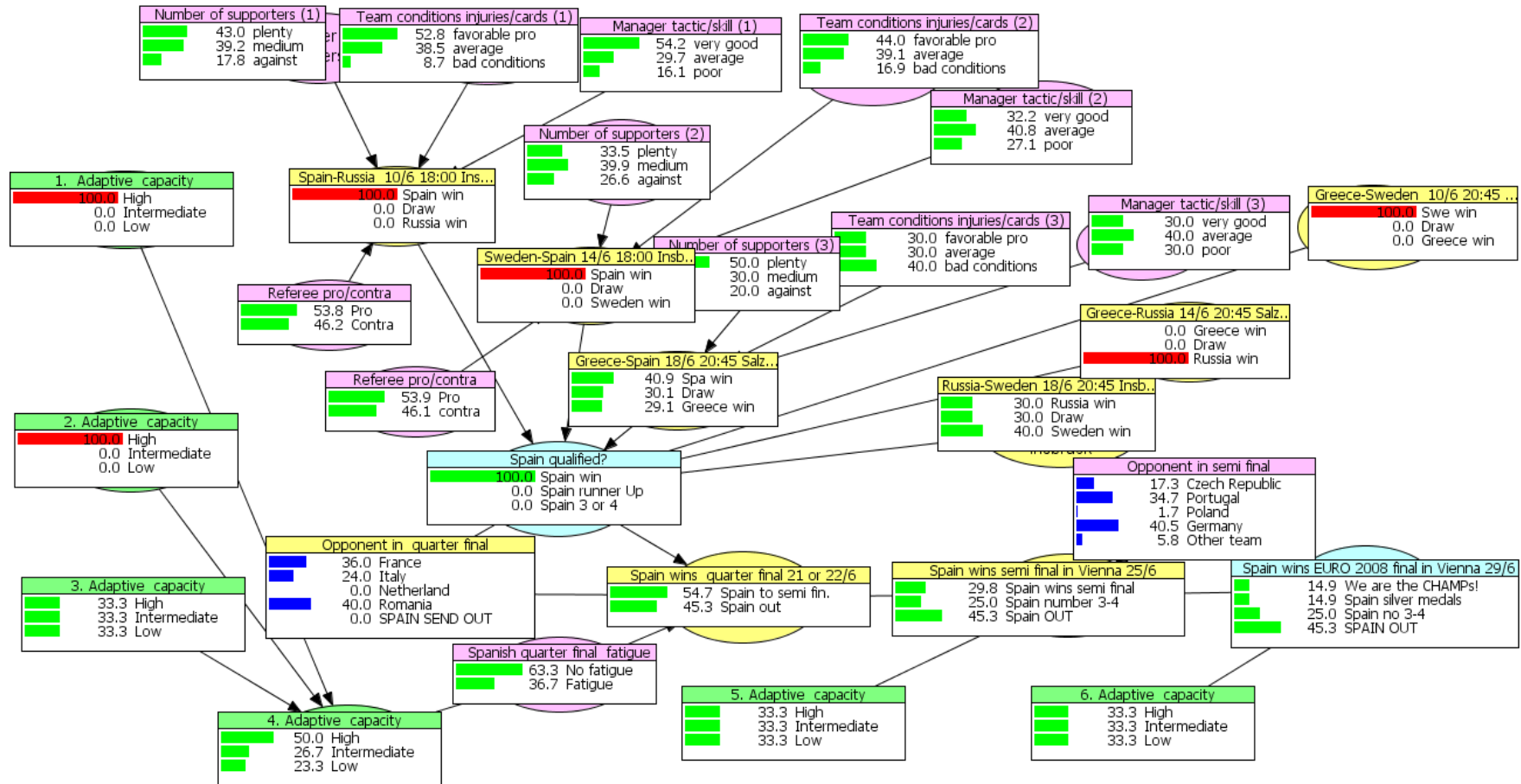
Initial probability 31 May 2008



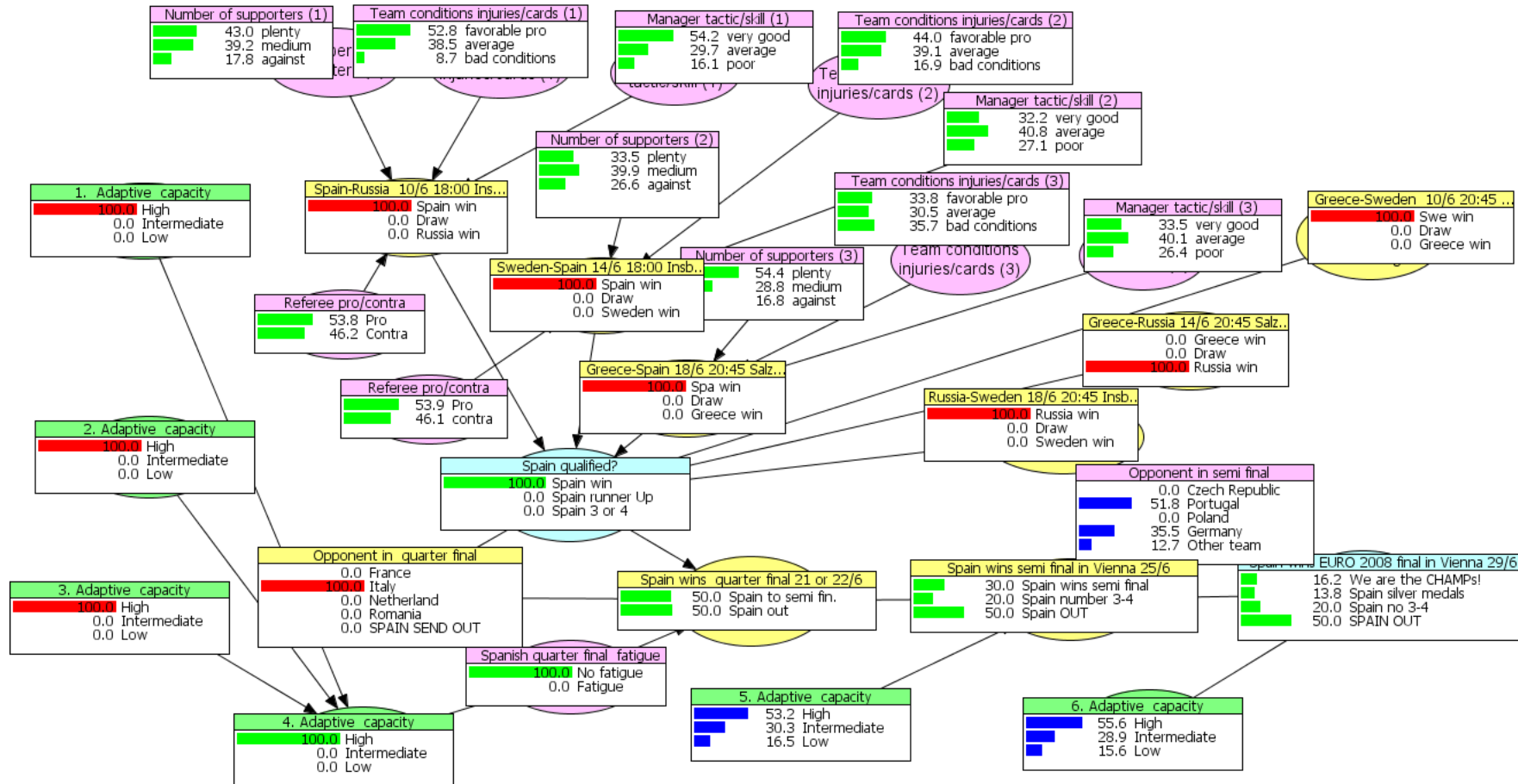
After Spains victory against Russia 10 June 2008



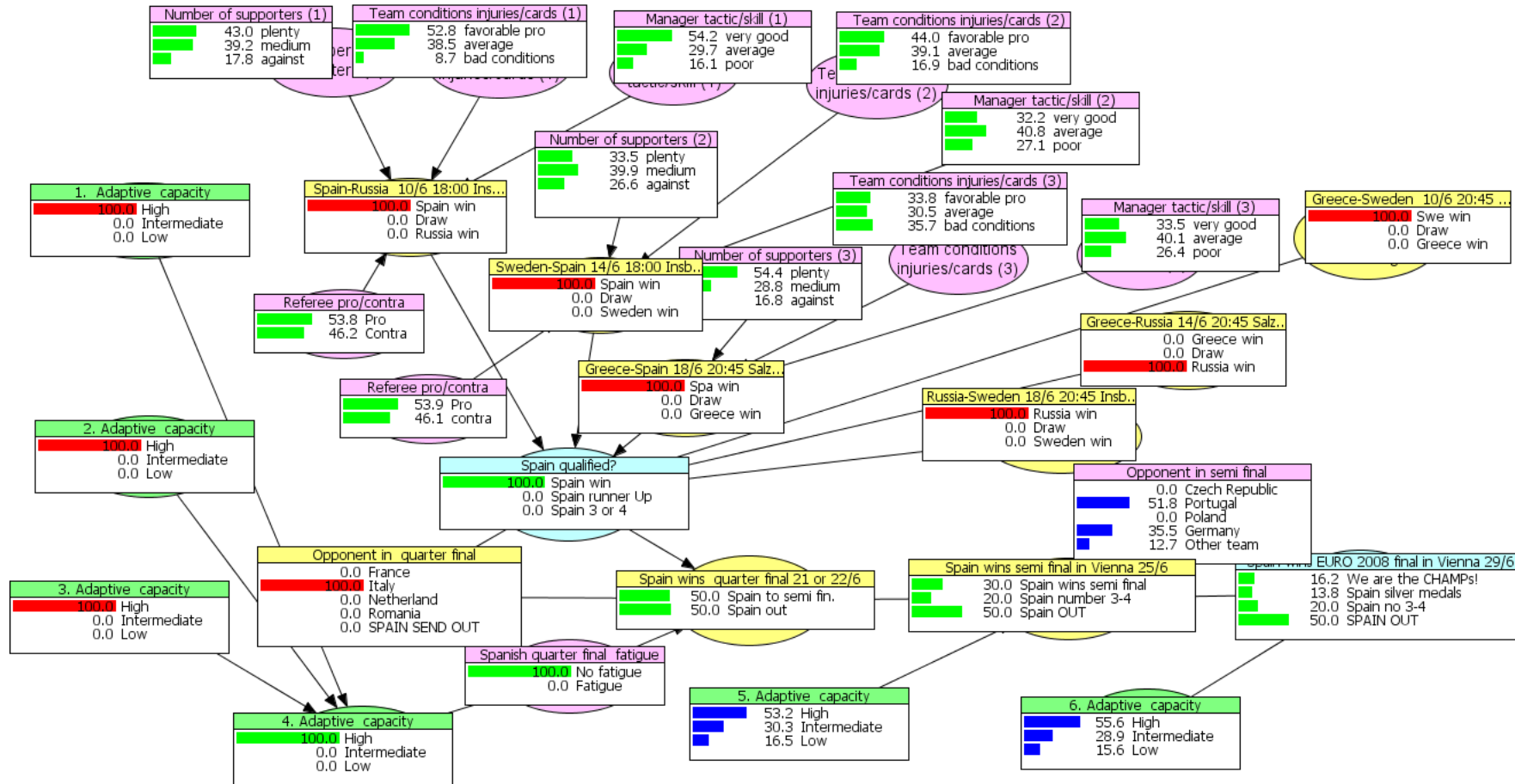
After Spains victory against Sweden 14 June 2008



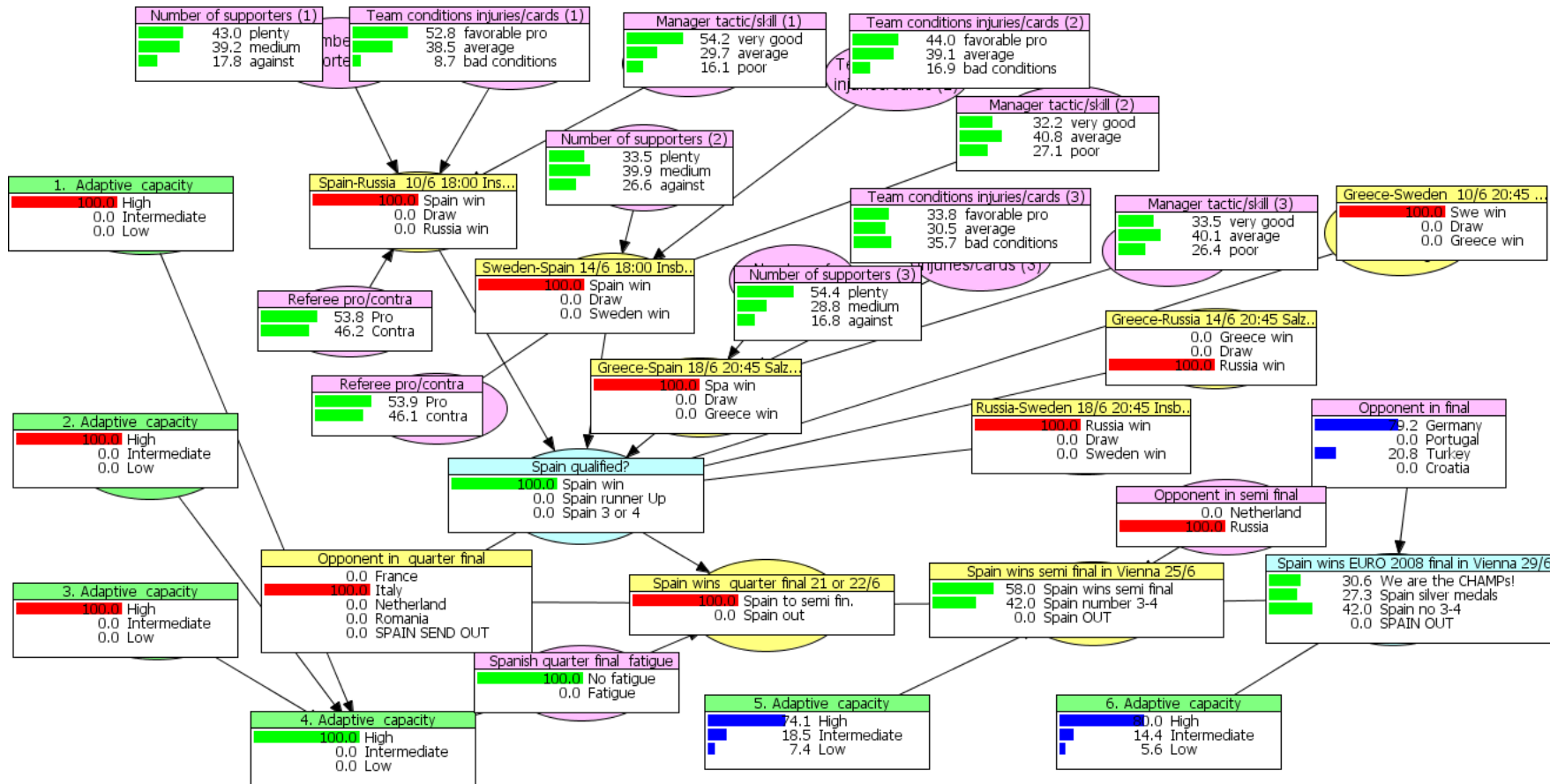
After Spains victory against Greece 18 June 2008



Before quarter final against Italy 22 June 2008



Before semi final against Russia 25 June 2008



Before Spains final against Germany 29 June 2008

