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Ski Jumping – Talent Battle in a Learning Organization

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The concepts of learning organization and organizational learning have made a significant contribution to the development of some major global companies such as Nokia, Oracle, Microsoft and others. This article explores whether the learning organization concept has proved successful in sports, specifically in ski jumping. The study was conducted among ski jumpers who compete in the World Cup. The questionnaire was distributed to 130 ski jumpers, and 54 correctly completed questionnaires were returned. The study has indicated that ski jumping is a sport of distinct individualists. Individual talent is an extremely important factor for success in this sport. We can say with absolute certainty that all surveyed ski jumpers are able to take 16th to 50th place in a World Cup race. The differences between competitors are very minor, even in the biggest races. Therefore, when it comes to success, every single detail matters. We have identified a weak correlation between the best sporting achievement and collaboration in the testing of new equipment. In the past, some of the best results were achieved on the basis of experimentation, but contemporary coaches do not dare to over-experiment with the technique. Too frequent progress measurements place a burden on competitors. There is a positive correlation between the frequency of individual analysis and the success of a competitor, while the best achievement and variables from "team work" group are negatively correlated. The relationships within a team are obviously very complex.

Keywords: learning organization, sports organization, ski jumping

1 Introduction

The goal of any organization is to operate successfully and maintain a competitive advantage, both in the present and in the future. However, there is a question of how to achieve this, considering all current events. The answer can be found in the approach to the learning organization concept. The latter does not only represent a different attitude towards knowledge but also affects the entire concept of organization, leadership and way of thinking. In the context of this article, we want to determine whether learning organization elements also apply to the field of sports organizations, specifically to the field of ski jumping. Therefore, the article first presents the theoretical background based on the learning organization and its connection with ski jumping, namely with the dependence of ski jumpers' success on learning organization elements. It then explains the methodology and results of our study, which investigates the impact of learning organization and organizational learning attributes in the training process on the results of ski jumpers.

2 Theoretical background

2.1 Learning organization concept

The theory of learning organization concepts was established by Fiedler (1967), Argyris and Schön (1978), Senge (1990), Huber (1990), Nonaka and Takeuchi (1995) and others. The first comprehensive model of contingent process innovation in an organization was developed by Fiedler (1967). He believed that the key success factor in individual leadership is a leadership lifestyle. He tried to determine which basic leadership styles can be identified, presuming that they are constant. Nevertheless, a constant leadership style can be a problem when environmental conditions change or when an organization is not achieving its objectives. In this case, it has to alter the objectives or replace the leader.

Argyris (1978) considers learning organization as a process of detecting and correcting errors. According to him, an organization should learn through individual learning. Huber (1990) states in his book that a learning organization is associ-

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ated with four constructs: knowledge acquisition, information distribution, information interpretation and organizational memory.

It is generally believed that the founder of the learning organization concept is Peter Senge. Senge's theory (1990) stems from the fact that the progress of the world is not achieved by some unrecognisable and imaginary forces but by the people who continuously expand their capacity and creativity, nurture and develop new ideas, have the possibility to freely associate with like-minded people and constantly learn how to learn together. In his opinion, learning organizations are those in which people continually develop their capacity to create the results they truly desire and in which new and expansive patterns of thinking are desired and natural.

In his book, Senge (1990) claims that a learning organization is based on five attributes: excellence of the staff and personal mastery of individuals, mental models, shared vision, team learning and systematic problem solving and systematic thinking.

The excellence of the staff in learning organizations mainly reflects in personal mastery of individuals and in self-control. The latter means that you are able to focus your active energy on the accomplishment of certain objectives in the long term, with the objectives usually being accomplished. The essence of a learning organization is to establish a link between an individual and the organization, i.e. between an individual learner and the learning of the organization.

In his book The Fifth Discipline, Senge (1990) describes "mental models" as one of the five disciplines of a learning organization. The term "mental model" is believed to have originated with Craik (1943). A mental model is a kind of internal symbol or representation of external reality. Individual's mental models are stereotypes, generalizations, preconceived notions and preconceived mental scenarios of how a certain thing should happen, what and how it should be and how someone should behave, act and even look (Craik, 1943). Mental models are often the cause or reason for a certain way of acting or non-acting. People mostly bring stereotypes, i.e. preconceived beliefs, into an organization. In a learning organization, it is therefore important to believe in goals, as this is also a kind of mental model. An organization as a whole has its own mental models and memory. Organizations have, according to Hedberg (1981: 6), cognitive systems and memories. Hedberg (1981) likens them to human beings, claiming that organizations can change and develop their personalities, habits, beliefs, and ideologies over time. He claims that organizational memories preserve certain behaviours, mental maps, norms, and values.

In creating a learning environment, it is important to replace confrontational attitudes with an open culture (McHugh et al., 1998).

Many people, including leading managers, have their own personal visions that never evolve into a shared vision or common goals of an organization. History has given us some examples of well-known people who had their own personal vision but were able to transform it into a goal of their organization and succeed. The reason for their success lies in their motivated staff that was capable of learning and willing to attain the goal. The shared vision is often to succeed against a competitor (Wang and Ahmed, 2003).

Belbin (1981) first began studying teams in the 1970s. He found out that individuals play different roles in a team. In his book (Senge, 1990), Senge argues that a team is the basic unit of learning in an organization. Teams are formed in order to produce synergetic effects among individuals. Team learning is the process of working collectively to achieve common objectives in a team. In the learning organization context, team members tend to share knowledge and complement each others' skills. If there is no commitment and effort from team members, then working and learning from team work may fail. This is why teams should be given freewill to act, especially in the learning organization context (Decuyper et al., 2010). Team is a group whose feature is participation in decision making and mutual help in defining goals and their achievements (Hoerr, 1999: 56-62). Main difference between a team and a group is that a group does not need a common goal or a cooperation of members.

Members of a team discuss their own goals, assess ideas, make decisions and act together towards the set goals. (Heller and Hindle, 2001).

The systems approach means that a whole splits into parts. The latter are usually less complex and easier to understand. The systems approach explores how the nature of individual connections between these parts affects the functioning of the whole. All natural phenomena occur according to certain laws. Society is a part of nature. Therefore, all processes in the society take place according to their own laws. As organizations are parts of society, social and technical processes in organizations can be explained by the systems theory. Although it is true that many innovations occurred by coincidence or by means of intuition, systems thinking is considered to be a conceptual framework and an essential development tool in the last fifty years.

The well-known model of knowledge transfer within an organization was established by Nonaka and Takeuchi. Nonaka and Takeuchi (1995) claim that knowledge creation is the result of interaction between tacit/implicit and explicit knowledge. This interaction occurs through the processes of socialization, externalization, combination and internalization. Knowledge socialization begins with the construction of connections that both enable and allow the organization members to exchange experiences and, consequently, create hidden knowledge. Externalization allows team members to get involved in the process of converting hidden knowledge into explicit knowledge. Combination permits the employees to systematize and exchange the newly acquired explicit knowledge and concepts as well as to transform the existing knowledge into knowledge-based systems.

Richardson (1995) proposes the "model of six building blocks". The first one represents systematic problem solving. In a similar manner as Senge, Richardson highlights the need for systematic problem solving. The second building block embodies experimentation, which includes systematic searching and testing of the new knowledge, while the third one represents learning from past experiences, which requires the systematic storage and continuous evaluation and assessment of successes and failures. The aim of analysing the errors is not

to find the culprit but rather to point out the errors that should no longer occur in the future. The unproductive success is a success for which no one knows how or why it even occurred. Furthermore, learning from others requires developing an organizational culture that encourages so-called enthusiastic borrowing or (Steal Ideas Shamelessly). It includes benchmarking among people in the same sector. Knowledge transfer is necessary if you want to gain new knowledge, as it is very difficult to become wise and full of knowledge in a passive manner. Progress measurement enables process management.

Dimovski et al. (2005: 25) say that learning societies of the 21st century are based on equality, open information, low levels of hierarchy, a wide range of control and an organizational culture that encourages flexibility and team work. The FUTURE-O model (Dimovski et al., 2005: 121–369) dictates the integrated implementation of the learning organization concept and emphasizes the integrity and coherence of all processes and employees on their way from vertical to procedural organizational structure, based on organizational learning. Psychological and social aspects are particularly important. The FUTURE-O model includes performance monitoring and evaluation.

2.2 Learning organization as a factor in the evaluation of ski jumping

According to different sources Olaf Rye showed the first measured jump in 1808. The Norwegian landed at 9.5 meters. But soon longer distances were reached. An outstanding jump was shown by Sondre Auverson Nordheim in 1860. At the Huseby Hill in Oslo the first annual competition took place since 1879 before this event was moved to the world-famous Holmenkollen in 1892. Already at the first Olympic Winter Games in history, 1924 in Chamonix (France), a ski jumping event was part of the program. The year of the first Winter Games was also the year in which the International Ski Federation (FIS) was founded. The FIS then started organizing regular ski jumping competitions five years later.

In Planica (Slovenia) in 1936 Sepp Bradl was the first jumper in history to fly beyond the 100 m mark. 58 years after Sepp Bradl showed the first jump over 100 meter, Austrian Andreas Goldberger was the first to land beyond the 200 meter mark on March 17, 1994. Unfortunately, he could not stand this jump and so the 203 m of the Finn Toni Nieminen later the same day count as the first official jump over this historic mark.

The facility in Vikersund (Norvay) is the world's largest hill with a hill record of 246.5 m (world record), set by Johan Remen Evensen of Norway (Feb. 11th, 2011) (http://www.fisskijumping.com).

Today ski jumping is one of the most popular disciplines in winter sports. Especially in Europe lots of fans come to the hills to watch the competitions and high ratings are reached with live TV coverage. At the moment this fascinating sport is practiced in about 20 countries on the World Cup level.

We often picture ski jumps as watching the final round of 30 jumpers. After the last competitor jumps, the story ends for the viewers. However, there is a huge organizational apparatus in the background, including constructors of ski jumping hills, equipment manufacturers, coaches, physicians, nutritionists, physicists, chemists and many others. In addition, competitions cost large amounts of money. For instance, the Sky Flying World Championships in Planica in 2010 was the most expensive sports event in the history of Slovenia. The expenses amounted to EUR 2 million, and the renovation of the facilities cost EUR 3.5 million. The budget of the event in Planica in 2013 was EUR 1.8 million. The financial investment in the construction of ski jumping hills in Planica in 2013 will total EUR 16 million, while the overall cost of building the new Planica Nordic Centre will amount to EUR 46 million.

Throughout history, ski jumping has experienced a tremendous development of jumping technique, hill profiles, equipment (bindings, boots, connection cord, ski jumping suit and skis), sports medicine, training methods and selection procedures for ski jumpers.

We believe that the use of learning organization concepts has had a considerable impact on the development: personal mastery of individuals, experimentation, systematic problem solving, systems thinking, learning from others and measurement. Some concepts have been used intentionally and some without the agents being aware of it.

Personal mastery of individuals

The history of ski jumping has been marked by high-calibre individuals. To mention just a few ski jumpers, constructors of ski jumping hills and coaches: Matty Nykänen, Simon Ammann and Jens Weissflog are the only jumpers who won two Olympic medals in the period from 1984. Reinhard Hess was a German ski jumping coach. He was the national team's coach from 1993 until 2003. With 21 medals won in world championships and Olympic Games combined, Hess was Germany's most successful ski jumping coach. Janez Gorišek is the constructor of the two largest ski jumping hills in the world in Vikersund and Planica.

Experimentation and development of ski jumping technique

The evolution of ski jumping has largely been the result of experimentation. Throughout the entire history of ski jumping, experimentation has been most evident in the changes to ski jumping techniques. Experimentation is in many cases associated with the personal mastery of individuals. After World War I, Thulin Thams and Sigmund Ruud developed a new jumping style known as the Kongsberger Technique. This involved jumping with the upper body bent at the hips, a wide forward lean, and with arms extended at the front with the skis parallel to each other. Using this technique Sepp Bradl of Austria became the first to jump more than 100 metres when he jumped 101 metres in 1936.

In the mid-1950s, Swiss jumper Andreas Daescher became the first jumper to hold the arms backwards close to the body with a more extreme forward lean. Then in 1985, Swedish jumper Jan Bokloev started spreading the tips of his skis into a "V" shape. Initially ridiculed, this technique proved so successful that by 1992 all Olympic medallists were using this style (http://www.olympic.org/ski-jumping-equipment-

and-history?tab=history). Successful experimentation always results in imitation.

Measurement and systems thinking – nutrition and sports medicine

Anthropologic data on ski jumpers have been collected at least since 1970, but more systematic collecting has begun in recent years. Since 1970, the average weight has decreased by 4 kg. Anthropometric data of ski jumpers was collected during the Olympic Games in Salt Lake City (2002; participation 81%, n = 57), during the Summer Grand Prix in Hinterzarten (2000; participation 100%, n = 92), and during the World Cup in Planica (2000; n = 56) (Muller et al., 2006).

Measurement and systems thinking – ski jumping technique

Ski jumping is a complex sequence of movement which should be realized in a very short period of time at 90km/h. The first reports on the systematic study of flight trajectory are almost two decades old. The K90 individual competition of the 1994 Olympic Winter Games was analyzed. The 2-D data (takeoff) were collected by a high-speed video camera, and the 3-D analysis (early flight) used an algorithm whereby two cameras followed the jumpers through the early flight phase (Arndt et al., 1995). Later it was found that the video camera was too large. Therefore, in 2011 experts from École polytechnique fédérale de Lausanne developed a new system for measuring the ski jumping trajectory within the project "Analysis of ski jumping performance using wearable sensors". The proposed system was composed of eight inertial modules (Physilog) fixed on torso, sacrum, thighs, shanks and skis. Each module, sampled at 500 Hz, included a 3D gyroscope, a 3D accelerometer and an embedded datalogger (Chardonnens et al., 2012).

Measurement and systems thinking – ski jumping hill profiles

In 1936 the FIS started to regulate the construction of the jumping hills and issued international standards. Ski jumping hills, which are to be homologated by FIS, need to be constructed to the actual FIS standards. Charts and formulas are based on extensive studies of biomechanical and physical actions of the World Cup ski jumpers during December 2006 on the large hill ‚Titlis' in Engelberg, Switzerland. The flight trajectory recordings, its analysis and the identification of the air pressure values were carried out by the Institute for Biomechanics of the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland under the direction of Dr Jachen Denoth and Dr Hans Gerber. Dr Hans Heini Gasser, member of the Ski Jumping Hills Sub-Committee, has prepared the geometric elements of a ski jumping hill by means of computer simulation of the flight trajectory and after the specification of the takeoff angle and the landing angle by the Sub-Committee for jumping hills. He has derived various construction specifications/calculation diagrams, which are to be used as a basis for a construction (Gasser, 2008).

Measurement and systems thinking – ski jumping equipment

History gave us several examples of innovative equipment resulting in a key competitive advantage. The ski jumping suit has had the greatest impact. Decades ago, ski jumpers wore trousers and a sweater. The first world record holder dressed in a ski jumping suit was Toni Innauer who jumped 176 metres in Oberstdorf in 1976.

In order to avoid the impact of the suit on the result, the fabric is prescribed. The fabric of ski jumping suits is made of 81% Polyamide gloss dtex 44f12 and 19% Elastane (Lycra) dtex 44f1; it has to weigh 180/190 g/m^2. The unstretched fabric must show a medium air permeability of a minimum of 40 litres per m^2/sec with 10 mm water pressure. (Fédération internationale de ski, 2010).

Even the smallest improvement of the equipment can affect the result. The example of the 2010 Olympic event winner in Whistler is well-known in this context. Swiss Olympic ski jumping multichampion Simon Ammann used a curved metal binding that allowed him to increase his aerodynamic profile and so hang in the air longer.

3 Methodology

3.1 Research questions

A review of the literature and history of ski jumping proved the impact of jumping technique, hill profiles, equipment and sports medicine on the development of this sport. We identified components of a learning organization in all these elements. In the rest of the study, we focused on the organizational aspects of the training process. We tried to answer the questions below:

R1: Does the presence of learning organization and organizational learning attributes in the training process affect the results of ski jumpers?

R2: How big is the impact of each learning organization and organizational learning attribute in the training process on the results of ski jumpers?

3.2 Instrument

The responses were collected through an anonymous online survey. The latter was conducted from 8 August 2012 to 5 September 2012. The questionnaire was composed of the following sets of questions: ski jumper's age (junior or senior), national team in the 2012/2013 season, the best result in his career so far, his point of view regarding learning organization and organizational learning attributes in the team.

Point of view regarding learning organization and organizational learning attributes in the team was studied by 67 statements (Q1 to Q67) through which the respondents rated their agreement or disagreement. The statements were divided into 10 sets: systematic problem solving and systems thinking, experimentation, learning from past experiences, learning from others, knowledge transfer, progress measurement,

personal knowledge, shared vision, mental models and team learning.

Answers to the statements were closed-ended. The following answers were offered:

Answer	Agreement	Frequency
5	I fully agree	Always
4	I agree	Often
3	I do not know	Sometimes
2	I disagree	Rarely
1	I strongly disagree	Never

3.3 Sample

A link with an invitation to participate was sent to 130 ski jumpers from six different countries: Slovenia, Austria, Germany, Norway, Finland, Poland and the Czech Republic. We wanted to include the best ski jumpers in the world as well as other team members of these countries. 54 correctly completed questionnaires were returned. Although it was small, the sample is representative considering the size of the entire ski jumping population. Tables 1 and 2 show the age of respondents and their best results.

Table 1: Age of respondents

	Frequency	Percent
Junior (up to 20 years)	10	18.5
Senior (over 20 years)	44	81.5
Total	54	100.0

Table 2: The best results of respondents

Ans.	The best result (Q)	Freq.	Percent
1	Among the top 20 in a National Senior (or Junior) Championship	0	0
2	1^{st} to 30^{th} place in an FIS race	1	1.9
3	1^{st} to 30^{th} place in an Alpine Cup race	1	1.9
4	30^{th} to 50^{th} place in a Continental Cup race	3	5.6
5	6th to 30^{th} place in a Continental Cup race	6	11.1
6	1^{st} to 6^{th} place in a Continental Cup race	5	9.3
7	30^{th} to 50^{th} place in a World Cup race	2	3.7
8	16^{th} to 30^{th} place in a World Cup race	9	16.7
9	4^{th} to 15^{th} place in a World Cup race	12	22.2
10	1^{st} to 3^{rd} place in a World Cup race, medal at the Olympics or World Championships	15	27.8
	Total	54	100.0

3.4 Results

For statements Q1 to Q67, we calculated the Cronbach's Alpha reliability of the measurement, which is 0.976. Answers to the statements are provided in Table 3.

We then analysed the connection between learning organization and organizational learning attributes and the best result of a competitor. We took into consideration that variables Q1 to Q67 are independent, while the competitive achievement of an individual is a dependent variable (Q). We calculated the Pearson correlation coefficients.

We identified a weak correlation between the best achievement and participation in the testing of new equipment (Q10, r=0.256, p=0.05) (Table 4). The results have revealed that not all competitors have the same opportunities for testing their equipment. In the large hill event at the 2010 Winter Olympics in Vancouver, the difference between Adam Małysz and Gregor Schlierenzauer was only 1.5 points. Therefore, according to a very small difference in some races, cooperation with equipment suppliers can represent a significant competitive advantage.

The study has demonstrated that, before a race on a ski jumping hill, competitors rarely analyse footage from the hill by themselves. Nevertheless, there is a weak correlation between the frequency of individual analysis and the competitor's result, but it is not statistically significant (Q16, r=0.256, p≥0.05) (Table 5).

The study has shown that in most national teams the coach and ski jumping profession measure progress. Competitors find this important. However, there is a weak negative correlation between the best achievement and the importance that a competitor attaches to testing (Q35: r=-0.205, p≥0.05) and comparing his progress with his teammates (Q38). This indicates that too frequent measurements place a burden on competitors and have a negative impact on their competitive achievements (Q38: r=- 0.268, p≥0.05) (Table 6).

We also performed a correlation analysis of the impact of variables (systematic problem solving and systems thinking, learning from others, knowledge transfer, personal knowledge, shared vision, mental models, team learning) on the best competitive achievement of an individual. Statistically important correlations for these variables were not found. However, this does not necessarily mean that they do not exist. At this point, we would like to emphasize that, as an opinion survey, our study had certain limitations. We also allow the possibility that the training process elements of the leading teams in the World Cup are so alike that their impact on the result cannot be identified by our research method.

Table 7 illustrates the correlation between team learning elements and the best achievement.

We then carried out a hierarchical regression analysis. The constant value is 7.796 (sig.=0.000). This implies that all surveyed ski jumpers are undoubtedly able to take 16^{th} to 30^{th} place in a World Cup race, even if training in different environments. These conclusions indicate the extreme importance of individuality for successful participation in ski jumping.

The hierarchical regression analysis (Table 8) suggests a low negative impact of progress measurement in the training process on competitive achievement (Beta=-0.396,

Table 3: Answers to the statements

Qn		Mean	Median	Mode	Std. Deviation
	SYSTEMATIC PROBLEM SOLVING & SYSTEMS THINKING				
Q1	Training is based on a systematic and quality approach.	4.37	5.00	5	1.033
Q2	We have a training schedule.	4.11	4.00	4	1.076
Q3	I respect the training schedule.	4.26	4.00	5	.975
Q4	I am placed in the national team or in a race on the basis of the measurement of achievements.	3.52	4.00	4	1.145
Q5	If a problem occurs, my coach makes a professional analysis.	3.98	4.00	4	.981
Q6	The management is responsible for my personal material existence.	3.24	3.00	4	1.045
Q7	The management is responsible for my overall personal development.	3.48	4.00	4	1.041
	EXPERIMENTATION				
Q8	The management of the national team always tries to find new knowledge and improvements.	4.02	4.00	4	.961
Q9	Competitors actively try to find new knowledge and improvements; the management encourages us in doing so.	3.87	4.00	4	.933
Q10	We collaborate with equipment suppliers when testing new equipment.	3.59	4.00	4	1.125
Q11	Due to experimenting, we have a separate/different training programme.	2.69	3.00	3	1.179
Q12	The coaches deliberately do things that I find unusual.	2.76	3.00	3	.889
	LEARNING FROM PAST EXPERIENCES				
Q13	I analyse my successes and failures by myself.	3.98	4.00	4	.981
Q14	I individually analyse my successes and failures by myself.	3.78	4.00	4	1.040
Q15	I analyse our approaches from previous seasons by myself.	3.54	4.00	4	1.077
Q16	Before a race on a ski jumping hill, I analyse training footage from this hill or the ones taken in previous seasons by myself.	2.44	2.00	1	1.208
Q17	We analyse our successes and failures with the coaches.	3.56	4.00	4	.904
Q18	We analyse our approaches from previous seasons with the coaches.	3.11	3.00	4	.984
Q19	Before a race on a ski jumping hill, we analyse training footage from this hill or the ones taken in previous seasons with the coaches.	2.09	2.00	2	1.033
	LEARNING FROM OTHERS				
Q20	I evaluate the successes and failures of other competitors by myself.	2.57	3.00	2	.983
Q21	We evaluate the successes and failures of the other teams with the coaches.	2.31	2.00	2	.948
Q22	In the national team, we share experiences with each other.	3.54	4.00	4	1.004
Q23	Everyone in the national team can bring a “stone to the mosaic” with his experience.	3.91	4.00	4	1.086
	KNOWLEDGE TRANSFER				
Q24	I write notes about my trainings.	2.98	3.00	4	1.236
Q25	We systematically collect and store scientific literature.	2.69	2.50	2	1.146
Q26	I read my notes about trainings from the past.	2.26	2.00	2	1.031
Q27	I watch the videos of other competitors’ jumps by myself.	2.43	2.00	3	.903
Q28	I watch the videos of my trainings by myself.	4.13	4.00	5	1.047
Q29	I read scientific literature.	2.63	2.50	2	1.138
Q30	The coach encourages me to be active in gaining experience and knowledge.	3.26	4.00	4	1.102
Q31	Together we are active in acquiring knowledge.	3.41	4.00	4	1.037

Table 3 (continued)

Qn		Mean	Median	Mode	Std. Deviation
Q32	We keep an archive of the videos of competitors' trainings.	3.80	4.00	4[a]	1.279
Q33	We have access to an archive of notes, videos and scientific literature.	3.57	4.00	4	1.002
	PROGRESS MEASUREMENT				
Q34	The coach and ski jumping profession measure my progress.	4.09	4.00	4	.875
Q35	I find regular testing very important.	4.02	4.00	5	1.124
Q36	I have access to measurement data of other competitors.	3.02	3.00	4	1.310
Q37	I have access to my own measurement data.	2.89	3.00	2	1.355
Q38	I compare my progress with my teammates.	2.76	3.00	3	1.080
	PERSONAL KNOWLEDGE				
Q39	The coach has profound theoretical knowledge of ski jumping.	4.35	4.50	5	.894
Q40	The coach has profound theoretical knowledge of training methods.	4.28	4.00	4	.834
Q41	I have profound theoretical knowledge of sports psychology.	3.37	3.00	4	.958
Q42	I have profound theoretical knowledge of ski jumping.	3.94	4.00	4	.920
Q43	I have profound theoretical knowledge of training methods.	3.56	4.00	4	.839
Q44	World-class specialists are always available to help.	3.72	4.00	4	1.106
Q45	Each team member can gain personal knowledge.	3.74	4.00	4	.935
	SHARED VISION				
Q46	I have my own competitive goals.	4.65	5.00	5	.828
Q47	The coaches are familiar with my goals.	4.04	4.00	5	1.027
Q48	The team has its team goals set.	3.61	4.00	4	1.204
Q49	Every team member is familiar with team goals.	3.24	3.00	3	1.164
	MENTAL MODELS				
Q50	I am especially pleased with a teammate's success.	3.74	4.00	4	.935
Q51	Regardless of the ski jumping level (good/bad form), I try to maintain the same level of behaviour.	3.41	4.00	4	1.190
Q52	The coach has the authority based on profession.	4.06	4.00	4	.899
Q53	We acknowledge the coach's professional authority.	4.09	4.00	4	.830
Q54	I am willing to accept the fact that I could be wrong in a particular case.	3.93	4.00	4	.908
Q55	Other teammates are also willing to accept the fact that they were wrong in a particular case.	3.26	3.00	3	.805
	TEAM LEARNING				
Q56	I prefer training with other teammates to training by myself.	3.89	4.00	4[a]	1.192
Q57	I do not consider my teammates as my opponents.	3.09	3.00	3[a]	.996
Q58	Every team member wishes all the best to the others and is happy when they succeed.	3.59	4.00	4	1.000
Q59	Team members are compatible in terms of personality.	3.72	4.00	4	.878
Q60	Team members play different roles in the team.	3.52	4.00	4	.818
Q61	Team members acknowledge each other's roles.	3.33	3.00	4	.869
Q62	Team members are aware of our roles.	3.33	3.00	3	.869
Q63	Team members have a leader.	2.94	3.00	3	1.071
Q64	Team members acknowledge the leader's role.	2.85	3.00	3	.979
Q65	We all benefit from team membership.	4.04	4.00	4	1.009
Q66	I am willing to listen to the other team members as I know this may broaden my knowledge and views.	3.85	4.00	4	.979
Q67	In the national team, we often talk and look for possible solutions and improvements.	3.61	4.00	4	1.017

Table 4: Correlation analysis – experimentation

	Q	Q8	Q9	Q10	Q11
Q8	-.079				
Q9	.171	.592**			
Q10	.256**	.531**	.524**		
Q11	-.018	.372**	.151	.556**	
Q12	-.055	.337*	.280*	.391**	.503**

Table 5: Correlation analysis – learning from past experiences

	Q	Q13	Q14	Q15	Q16	Q17	Q18
Q13	.095						
Q14	.120	.773**					
Q15	.031	.581**	.446**				
Q16	.256	.262	.305*	.248			
Q17	-.008	.544**	.395**	.463**	.219		
Q18	.089	.413**	.264	.530**	.497**	.311*	
Q19	.008	.095	.090	.328*	.647**	.328*	.491**

Table 6: Correlation analysis – progress measurement

	Q	Q34	Q35	Q36	Q37
Q34	-.069				
Q35	-.205	.689**			
Q36	-.071	.311*	.397**		
Q37	-.084	.200	.138	.044	
Q38	-.268	.324*	.485**	.256	.136

Table 7: Correlation analysis – team learning

	Q	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65	Q66
Q56	-.211											
Q57	-.285*	.549**										
Q58	-.013	.547**	.550**									
Q59	-.089	.511**	.505**	.685**								
Q60	-.129	.370**	.172	.378**	.388**							
Q61	-.152	.310*	.182	.268	.346*	.761**						
Q62	-.182	.219	.313*	.203	.371**	.575**	.750**					
Q63	-.045	-.005	.005	.172	.204	.313*	.405**	.426**				
Q64	-.032	-.031	.130	.226	.302*	.263	.436**	.525**	.855**			
Q65	-.201	.317*	.466**	.520**	.502**	.548**	.524**	.524**	.299*	.311*		
Q66	-.252	.357**	.382**	.534**	.632**	.451**	.414**	.436**	.316*	.331*	.636**	
Q67	-.180	.477**	.558**	.490**	.553**	.292*	.320*	.470**	.188	.301*	.474**	.604**

sig.=0.043), a negative impact of team learning (Beta=-0.942, sig.=0.001) and a low positive impact of learning from others (Beta=0.423, sig.=0.045).

4 Discussion

The analysis has led to some interesting findings. Training is in most cases carried out systematically and follows a training programme. Problems are also mainly handled systematically. Nevertheless, it has been observed that competitors are not necessarily placed in a race on the basis of their achievements. We are worried about the general lack of concern for the overall personal development and personal material existence of competitors. This conclusion is confirmed by the examples of some top ski jumpers from various countries who had problems after having ended their career (e.g. Matti Nykänen, Andreas Goldberger, Primož Peterka).

Table 8: Regression analysis

Model	Unstandardized Coefficients		Stand. Coeff.	t	Sig.
	B	Std. Error	Beta		
(Constant)	7.796	.264		29.520	.000
REGR factor score 1 for analysis Systematic problem solving	-.198	.530	-.090	-.374	.711
REGR factor score 1 for analysis Experimentation	.343	.501	.156	.684	.497
REGR factor score 1 for analysis Learning from past experiences	.061	.454	.028	.134	.894
REGR factor score 1 for analysis Learning from others	.928	.448	.423	2.070	.045
REGR factor score 1 for analysis Knowledge transfer	.068	.491	.031	.139	.890
REGR factor score 1 for analysis Progress measurement	-.868	.417	-.396	-2.081	.043
REGR factor score 1 for analysis Personal knowledge	.704	.555	.321	1.270	.211
REGR factor score 1 for analysis Shared vision	.744	.513	.339	1.450	.154
REGR factor score 1 for analysis Mental models	.313	.587	.143	.533	.597
REGR factor score 1 for analysis Team learning	-2.066	.592	-.942	-3.492	.001
a. Dependent Variable: My best result is					

Ski jumping is a sport where some of the best results have been achieved on the basis of experimentation. This applies to equipment improvements as well as to revolutionary changes to jumping technique (e.g. position of the arms during the flight phase, position of the arms during the crouch, the crouch itself and style changes). V-style pioneer Jan Boklöv amazed in Oberstdorf in the 1986/87 season when he jumped differently than all the other ski jumpers. He reached up to 10 m longer distances.

The study revealed that the ski jumping profession constantly seeks new knowledge and improvements. However, coaches do not dare to take risks and rarely do things that ski jumpers find unusual. Perhaps the reason lies in the fact that the coaches are not familiar with learning organization concepts. Jafari and Kalanaki (2012) state that there is a significant relationship between the dimensions of learning organizations and readiness-to-change.

Garvin, Edmonson and Gino (2008) indicate the importance of learning from past experiences in the case of the U.S. Army's After Action Review. This process is framed by four simple questions: What did we set out to do? What actually happened? Why did it happen? What do we do next time?

Our study has found that ski jumpers often analyse their successes and failures by themselves. It is very surprising that they rarely watch footage of the relevant ski jumping hill from previous seasons before a race. Wade Boggs, third baseman for the New York Yankees, winner of five batting titles in 12 years, videotapes all of his at bats. The morning before a game, Boggs arrives early at the ballpark and watches videos of his past bats against that day's opposing pitcher (Barret, 1995). Among all questions in our questionnaire, we identified the lowest level of agreement with the following statement: "Before a race on a ski jumping hill, we analyse footage from this hill with the coaches." (Q19: Mean=2.09, Median=2, St.dev.= 1.033)

Team members exchange experience with each other but not as often as one would expect. It is surprising that competitors rarely analyse the successes and failures of the other teams.

Competitors rarely collect and store scientific literature, rarely read notes about their trainings from the past and rarely watch footage of other competitors' jumps, although the coaches encourage them to acquire knowledge. On the other hand, they often watch footage of their own jumps.

Progress measurement is quite common in ski jumping. Competitors often do not have access to data of other ski jumpers.

Competitors generally do not doubt the profound knowledge of the coaches. Nevertheless, we have noticed that they do have doubts about their knowledge of sports psychology. We believe that this kind of knowledge is important for competitors in a sport like ski jumping.

Among all questions in our questionnaire, we identified the highest level of agreement with the statement about personal competitive goals (Q46: Mean=4.65, Median=5, St.dev.= 0.828). As for the team goals, many are not familiar with them.

Competitors generally acknowledge coaches' authority. Team members wish all the best to their teammates and are

often happy when they succeed. On the other hand, they are not necessarily willing to admit their own mistakes.

Competitors are aware that they all benefit from team membership. However, the relationships within a team are obviously very complex. They can consider their teammates as their opponents but do not necessarily acknowledge each other's roles. They are aware of different roles within their team. Attitude towards the leaders is also not entirely clear.

The study proved that ski jumpers are individualists. Those who prefer training alone to training with their teammates, consider their teammates as their opponents and are willing to listen to their teammates have statistically significant advantage over the others. There is a negative correlation between the "best achievement" variable and the following variables:

- I prefer training with other teammates to training by myself.
- I do not consider my teammates as my opponents.
- We all benefit from team membership.
- I am willing to listen to the other team members as I know this may broaden my knowledge and views.

5 Conclusion

The learning organization concepts have made a significant contribution to the development of some major global companies. Creating a learning organization remains the ideal for many managers around the world. The case of Samsung Electronics transformation under the leadership of Lee Kunhee has been approached under multiple theories as proposed by the concepts of communication, paradigm shift, strategic vision and intent to bear a series of multiple strategies under the process of learning organizational theory (Hur Chul-boo, 2010). For Microsoft to build up a learning organization's strategy, it can be concluded into 3 ideals: the first is self-criticism, the second ideal is message feedback and the third one is a wide-ranging exchange.

In addition, the importance of learning organization elements has been proved in some team sports. Shamsie and Mannor (2013) have done the analysis of a large sample of Major League Baseball teams from 1985 to 2001. The analysis provides significant support for the importance of tacit knowledge for the performance of a team.

Based on our study of ski jumping as a complex system, development of ski jumping technique, development of hill profiles, development of equipment and development of sports medicine, we believe that the development of ski jumping was not the result of a coincidence. It was, rather, influenced by learning organization elements: personal mastery of individuals, experimentation, systematic problem solving and systems thinking, learning from others and measurement.

How do learning organization elements in the training process affect competitors' results?

We have identified weak positive connections between competitive results and preliminary analyses of the jumps on the relevant hill, possibility of testing new equipment and willingness to learn from others. Too frequent progress measurements have a negative impact on results.

Correlation coefficient numbers hardly give us answers regarding their actual importance. Therefore, we analysed the results in recent major competitions. There are two series in a ski jumping race: the overall score is the sum of points from both jumps. We have found that the differences between the best ski jumpers in the biggest races are extremely small. At the 2006 Olympic event in Pragelato (normal hill), the winner was Lars Bystøl (266.5 points) and Matti Hutamäki took second place (265.5 points). The difference between them was therefore only one point, i.e. less than one meter. A similar thing happened at the 2010 Winter Olympics (Normal Hill, Whistler Olympic Park). The difference between the second (Adam Małysz) and third competitor (Gregor Schlierenzauer) was only 1.5 points, which on this hill signifies less than 1 meter in length.

To conclude, even the smallest element of the training process can contribute to a success or failure.

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