

1 Roles and general work

In general many things in organization level looks good and robust to me. System allows professional athlete work and is not any kind of reason not to perform well. There is money in the system to help athletes development (camps, tests, coaches,...). Problem with the money can be with the ski technician job. Big countries are using at the moment from 5 to 15 times more money on ski service. That can be problem for future chances of smaller countries.

What I would expect more from system on all levels is more positive attitude for athletes development. Modern young people are doing cross- country skiing because it's fun to do sports. It is not so much about fighting for something or making a living. This is important when you create teams and work with big organizations like Ski Federation, Dukla and Olymp. It should be little bit everybody's business that cross-country skiing is fun and motivating on all levels from small kids to professionals in A-team. It is everybody's job to be positive and constructive to other people working with cross-country ski Czech. I don't say that I would have negative experiences more than normal in this work, but too many times our athletes are told that they are shit or bad. That is neither constructive or positive. What athletes need is more feedback about what is good and what is not working, and how to develop these things. It is very dangerous thing to say some person is bad. You say it to too many people and you continue working alone. That is big challenge for hard individual sport like cross-country skiing when competing for athletes, coaches and other staff members with other sports.

1.1 Dukla

It is easy to see that Dukla was one of the most successful systems in the world of sports and it still is very powerful system. It works especially well when it is located next to facilities, like with athletics in Praha. This is problematic in Liberec. For almost every training you have to drive 10-60minutes. That is not optimal, luckily many athletes have better training facilities at home. Most of trainings should start from doorstep. In professional system you should find a place to live where is minimal traveling to trainings. Dukla Liberec is very useful if you live in a place with bad conditions to train.

I hope Dukla would open recovery facilities to evening hours (athletes need it after trainings in evening 17-21). I also hope that people working in Dukla learns about new generations ways, and don't expect them to need coaching all the time. It is much better for athletes motivation and learning when they are given time to train and organize things alone. Athletes who need coach around them all the time normally don't achieve the highest level.

1.2 Executive Board and Coach board

This is very good system on paper. Coach board is looking for coaching things in all categories and executive board take care of budget and staff selections and general big things.

I hope boards find a way to make 2years contracts with good athletes. It would make it more safe to take risks in hard trainings to reach top. That is quite normal for high level athletes to have bad seasons when trying too hard.

I hope for coach board to ask more often what has been so good with athletes that now are coming to World cup-level. For example Michal and sprinter ladies. It is many times talking about what is wrong with czech skiing. Now is coming some athletes to World cup-level. What is reason for these positive things?

1.3 Office (Sacher + Bartonova)

These two jobs are very much the same as in Finland. Secretary has a lot of strings in her hands and her knowledge and experience about practical things is very useful. Job of Sacher is normally most hated by the athletes and coaches. That is because he is the person to say, "no, there is no money for that." In Finland this boss normally changes after every 4-8 years because it is hard to be "no"-man. For my experiences I don't have big issues or ideas for these two. In my point of view, they are doing good job.

1.4 Coaches

The general structure in my opinion is working quite well for national team that there is Ladies and Men coaches and assistants for both. In perfect world I would take also job for head coach who makes general programs for camps, practical things, leadership things for World Cup (also leading service chef and team) etc. Detailed program would be done by Ladies coach and Men coach. I would always prefer university level of education on sports and coaches social leadership skills. Of course you should have some background as a competitive skier, but level of competing self is not correlating necessarily to coaching skills.

When selecting a team of coaches, it is perfect when you can find some alternative strong points to the team. You need some older coach to understand longer timespan, you need younger coach to have energy and better understanding of athletes generation. You need university of sports education to have vision, to understand idea behind training, maybe you need ex- top athlete to know about real requirements of high level skiing. From everybody in coaching team I would expect open mind to discuss and develop training systems and very good social skills to be able to work with lot of different kind of people. I think it's coaches job to find the right approach for each athlete, not vice versa.

At this time in Czech skiing, I would actively work with younger generation of coaches and give them lot of responsibility. You need to have a system to bring new coaches to the system and give them work. Now is good time for new coaches to start when athlete generation is changing. It should be actively sought, the new better way of coaching.

1.5 Service team

My expertise is not to tell how skis should be prepared. Here I only talk from my own perspective. In general our service team is working very well. In most races, our skis are competitive to our opponents. Many times the best skiers have best skis, but this is nature of our sport. When our athletes get better results, the skis they get from companies will be better.

One thing that should be improved as a team in work with skis is to make better working trios "athlete-serviceman-ski brand tester". Our athletes are not active enough to talk with ski brand representatives and working with own serviceman is not optimal also. If I look on the best athletes, this three combination is working perfectly and athletes are very active members. The level of result alone doesn't give you best skis, you have to work with ski brand representatives and own serviceman.

Big problem in international Cross country skiing is price of ski preparation. Big teams grind their skis and travel with big wax trucks and grinding machines are transported to important competitions also. All this cost a lot of money. When you add here the fact that Team Norway test skis with 16 men when we have 4 or 5. Naturally in some point it starts to make a difference that is hard to catch.

What should be future tactic then? I will give three alternative ideas. I'm not the person to say what would be working or not.

1. Work in FIS to make rules that would make waxing costs lower and preparation more equal to smaller countries (I guess it is not realistic goal to compete in money race against NOR and RUS here)
2. Start a grinding project. You have to hire some people to work with own grinds. This costs some money, you need to buy machine or even machines and you don't know how many years

it takes to have results. Germans said they had project for 15 years and last winter in Seefeld was first one with some substantial benefit.

3. Buy a truck and make working conditions better for servicemen. This doesn't give you straightforward benefit, but improving servicemen working conditions improves general wellbeing. Now it doesn't look very comfortable job to have for many years, and if servicemen are changing a lot, level of skis can go down also.

1.6 Medical team

This system was very different from Finnish one and I'm not expert on medical things neither. I still share some ideas from my point of view. Physiotherapists work with different method than Finnish ones. That made it hard for me in beginning to understand. Good thing in Czech system is that physiotherapists work little bit like movement coaches. That is really good in improving athletes performance and preventing injuries. For us was very beneficial to have same physios working for same athletes all year. You can see how well it worked when Martina worked with girls for two years. Physiotherapist should be working together with coaches and improve results by improving athletes movements. It is not massage or stretching or some recovery gear that makes big difference in results. How athlete can use his body makes big difference.

With doctor it was clear from beginning that idea or philosophy about asthma is totally different compared to Scandinavia. In Scandinavia it is found out that cross-country skiing may cause asthma-like symptoms. How to analyze and treat this problem is not very focused in Czech. That's why I hope Team Doctor's contact to Finnish counterparts would continue and we would get Czech athletes to Finnish asthma tests etc. This is needed to get more knowledge about our athletes breathing functions and to get FIS to say something about asthma also.

1.7 Athletes

For athletes I would say three big ideas how to improve their general result.

1. If you want to be top athlete you need to be professional. I would say no studying, no other jobs or major projects. Nobody in Finnish A-team is doing studies or going working. It really isn't option if you want to train 900-1000 hours a year and have full recovery. You should make your life choices so that between 18-25 years of age, you live in a place where is easy to travel to training facilities, you train 700-1000 hours/year, you minimize disturbance in recovery. When you do this for 3-5 years between these ages, you pretty much know where your capabilities lie.
2. Educate yourself about training, about skis and about english language. You have to be ready to talk about trainings with your coach. You have to be ready to take yourself to next level as an athlete. Understanding how body works makes your motivation and skills to train much higher. If you want best skis, you have to work hard and find them. You have to be ready to talk to people to help you. You have to be ready to test a lot of skis. You are most motivated person to find best skis for you. Learn english. It is double hard to get to the top if you always have to rely on other people. Learn english and use it a lot.
3. Be active, constructive and positive. Athletes job is to get 5-10 people to work for them. Athlete needs coaches, servicemen, physiotherapist, doctor, federation bosses, federation secretary maybe psychologist, manager, nutrition therapist. If you tell these people nothing or make them feel bad in some other way, they stop working optimally for you. Athlete needs many people to reach his highest level. If you treat people with respectful manner, they will like to help you. This is everybody's responsibility in sport process.

2 Physiology and biomechanics of skiing

2.1 Role of VO₂

Maximal oxygen uptake is single most important determining factor for Cross-country skiers capabilities. It mostly depends on hearts cardiac output. That means how much heart can pump blood in one minute. Cardiac output is determined mainly by genetics and physical activities during childhood and puberty. When general growth stops, substantial changes in cardiac output normally stops. Modern skiing with sprints, shorter courses, mass starts and faster gear, makes importance of VO₂ smaller, or in other words, you can be top skier without the highest VO₂. It also isn't any kind of automat. There are many skiers who have over 80 ml/kg/min VO₂ and they are far behind WC-level. They are just too slow or weak to be fast enough on skis. For young athletes testing you should look for skiing speed and high max VO₂. If you have both on high level, you have good possibility to be professional. If you are only fast or only high VO₂, it's much harder.

2.2 Training the heart

Training the VO₂ and improving the hearts capacity is working quite good in Czech system. There is enough hard intervals, races and tests in growing ages. For the full development of the heart you on average need 2-3 VO₂ trainings/week. Science suggests that beginners or young athletes (11-13 years) should focus on shorter intervals (20s-40s) and experienced high level adult athletes can benefit from 7mins intervals to 60mins trainings. Of course all the variable hard trainings of variable durations should be used for all development stages. This approach makes good sense cause when you are starting to train you can keep good pace for 1min max. When shape grows you can keep it longer and longer.

2.3 Training the neuromuscular system

Even if VO₂ is single most important factor, it doesn't simply tell you how to become a skier. The skiing skill is in our neuromuscular system, in our brain, in our skeletal muscles, in our nerves. I guess it is almost every skeletal muscle of the body you need to activate during a ski race. That gives us huge area to put training on. There is big potential for development.

For every step of the athletes way to the top, i would train for the skill to ski fast. It is normal in sports that your performance is decided by explosive strength or speed strength capabilities. This is something that I think Czech skiing should focus to change. It should come from two ways, you should have more strength training from 13-14 years old and you should make a lot fast skiing and roller skiing when 11-18 years old.

For example you can make 5-15x6-8`` 90-100% fast skiing 1-6 times a week. Or you can make 20-40x20`` 90-95% fast skiing 1-2 times a week. It can mean also roller skiing 5x5` and 2` on flat or on slightly downhill. It is also possible to have speed attacks inside normal intervals. It is also good to make sometimes I1 skiing/roller skiing on flat when you have to ski fast even when heart is not working hard. And all this has come with training maximal strength. When maximal strength is trained it makes speed trainings useful. If you don't make any maximal strength, your body response to speed trainings is lower.

2.4 Role of mitochondria

You need high intensity trainings for VO₂ and high speed impulses and strength training to be fast. Why do you the need 800-1000 hours/year? Most likely reason is to develop cell organelle called mitochondria. Mitochondria is organelle where happens all energy production in our bodies. The higher density of mitochondria you have in muscle cell, the higher is muscles capacity to recover from physical workload. The biggest determinant of mitochondria density is how much you have trained those muscles. The more you train, the more you get mitochondria in your muscle. Strength training enhances also endurance trainings effect, because you have more muscles to create mitochondria to.

You can develop mitochondria roughly in two ways. Training a lot gives you more mitochondria. Training hard gets mitochondria working faster. This gives you good reason to train short maximal intervals like 2x7x30"/30". Then you get to put out full power, muscle has to find the way for high energy. And also you get to ski many times very fast, which makes your neuromuscular system more skillful for fast skiing.

3.0 Strength training

This is one of main things Czech skiing has to take seriously. The change in Cross country skiing has come from development of maximal strength and thereby speed strength and maximal skiing speeds.

3.1 How to build strength training program

Strength training program should be based on athletes level and experience on strength training and what kind of goals there is in his sports. Successful strength training programs alter system every 4-8 weeks. For example 8 weeks basis training with longer series + 8 weeks hypertrophic maximum + 8 weeks maximal strength + 4 weeks explosive strength. Generally development goes from longer series to shorter and from lower weights to higher and recovery from short to long. during explosive strength stage you normally have peak in athletic result. To have this progress from longer series to shorter with more power you have to do it inside training season and during career. For example, training jumps of various kinds, good training basis is 600-1000 jumps 50-75% from maximum in one training. That is good training for young kids any time during summer/autumn and top athletes base training in may/june. For adult athlete in autumn or just before winter is very good 6x6jumps with 100%. That is not optimal for prepuberty athletes cause they don't have high power output.

3.2 What kind of strength training is needed

Minimally 50% of speed comes from poles during a ski race. That means that you have high strength requirements in upper body. Especially shoulder flexors and elbow extensors. Maybe even higher need for strength is in trunk flexors and stabilizers meaning abdominal muscles. Generally for movement is economical to have big muscles in body and smaller elastic muscles in periphery meaning limbs.

First you need to do strength training for muscles to get metabolism working inside muscle. This means longer series with short pauses. This is needed for the base of training season and for the base of young athlete.

Secondly you need maximal hypertrophic training. That means 6-12 repetitions and longer recovery (2-3') This kind of training is optimal for muscle growth. After this you need maximal strength training to develop nervous system. That is 1-5 repetitions with 3-4' recovery. Maximal strength training is vital for optimal speed development and hormonal function of body. Especially female athletes should do minimum 20mins maximum strength in 9 days during all year. Male athletes possibly can survive longer than 9 days if explosive and dynamic strength training is used. Younger athletes and beginners should focus on lighter weights and more than 10 repetitions. They should focus on learning weight lifting techniques. Heavy loads should start typically in last part of puberty.

You should always look for more short strength trainings than one long one. For example 2-4x20-30mins in a week is better than 1x60mins. Very good way is to organize short strength sessions together with shorter i1 training. For example 60mins roller skiing + 30mins maximal strength. Training system for a cross country skier should also in average have same amount or more intensity training hours than strength training hours. That makes the metabolism work in muscles, and metabolism is bigger part of result in skiing than actual strength. But maximal strength gives you a limit how fast you can go.

4 General ideas on making a working training plan

4.1 How to build a training plan

In this chapter i give you my ideas about how to make a training plan on weekly basis. There is lot of things in cross country skiing you should train for. There is endurance, speed, strength, VO2, skiing skills. In general biggest problem in planning endurance sport training is, how to train a lot and still recover to higher level. To get maximal endurance input to body, first you need to have maximal number of trainings, second you need some different speeds in trainings, third thing is to have some length in trainings.

To have lot of trainings in a week, I normally plan one rest day a week, not more, not less. Then I normally plan 2 trainings on five days and one longer on one day. Kids in school can have many exercises during week if they for example go to school with bike or walk, they have sport lesson, they do ski training, they play football or something with friends. One of best athletes i have had 15-20 exercises a week when he was 14-16. Only 5-7 of them was ski trainings.

To avoid overtraining the daily training load should vary. Thats why I normally have three hard days that can include, intensity training, strength training and hard speed trainings. The remaining three days should only include i1 and few possible short sprints.

Example week for elite or junior national team

Monday (moderate)	I II	Speed 15x10`/2-3` Roller classic Run 60 + Maximal strength 30
Tuesday (easy)	I II	Double poling 2.00 I1, including 5x8`` speed Run 1.30-2.00 I1
Wednesday (hard)	I II	Roller ski skate 6x4` ANP + 10`` finish attack in every interval Elghus 5x7` ANP
Thursday (easy)	I	Run 3.00-3.30 I1
Friday (hard)	I II	Double poling 2x(7x30``/30``)/8-10` Run 30 + Maksimal Strength 30
Saturday	Rest	
Sunday (easy)	I II	Roller ski skate 2.00 I1, including 5x20`` easy dvajedna run 1.30 + easy circuit training 30

5 Psychology in cross country skiing

5.1 Holistic approach

In Scandinavia (can be a global trend too) you have a big science based thing to have a holistic approach to coaching. This means coach cares about total person, all aspects of athlete, not only following training plan. More successful coaches care about their athletes. They want to know how life is going in general. They are curious about how athlete is feeling how he want his life to be. We humans are Physical, psychological and social creatures. Training has no use if some of these areas is having problems. Happy athlete is almost only athlete that can develop. It doesn't mean that coach can help in social or psychological problems, but if coach shows interest and understand how it affects training, it can lead to much better working together between athlete and coach. Holistic approach allows coach also to find what trainings are fun. That is super important in developing athletes. Fun trainings are normally the best ones. Who wouldn't like fun, anyway?

5.2 How to build motivation

Motivation is not steady and firm. It isn't something that somebody magically has and somebody doesn't. Very important factor for athletes motivation is how they are coached. It is not only factor, but it is factor we can change. Motivation can be divided to intrinsic and extrinsic motivation. Extrinsic motivation comes from influences outside of individual. This side works good in Czech cause there is good glory for high level athletes.

Intrinsic motivation is not so simple thing. It means self desire to develop yourself. In self determination theory there is three keys to better intrinsic motivation: perceived competence, perceived autonomy and social cohesion.

Perceived competence means trust in own abilities. In coaching you should emphasize self reflecting, trying and learning new things. It is very important for a coach to ask athlete if he thinks training is teaching him something new or getting him closer to his goal. Or asking how athlete feels about learning the new task. How is this double poling feeling now after two months of strength training?

Perceived autonomy means how much we feel that we can affect our daily choices. This is very important for motivation. Sweden's ladies team this year had 61 days national team camps. Other days athletes could decide themselves how they work with which coach or not coach at all. They have very high level of motivation and drive compared to many other teams. In Czech coaching system should not be driven to more camps or more days with coaches. It should drive for education. In Scandinavia it's normal that adult athletes train mostly without any strict coaching, only mentoring and some plan making. This is better for intrinsic motivation. Although we have to remember that almost all swedish, norwegian skiers go through very high level sport gymnasium education system where they learn to coach themselves.

Motivation is not a problem when athlete understands that he has to find his way himself. There will not be magic coach coming to rescue.

5.3. Communication

This is maybe not psychology but this is very important for Czech cross country skiing. We have to find a way to tell real things to our team mates. Very big things there is talking between athletes and servicemen, athletes and athletes, coaches and coaches, athletes and coaches. Talking to each other real things is very good quality meter about atmosphere. My friend is Finnish champion in Ice Hockey. Best team she played had an atmosphere that any player could any time tell any other team member that "this was shit from you, i want you to perform better", and it wasn't a fight. It was a discussion. This also applied to positive things. I hope there would be safe environment for every member of Czech team to tell their honest opinion directly. This is hard task.

6 Junior Training, Sweden Cross-Country Skiing line

For the juniors, I would follow Team Sweden yellow-blue line. To translate this from Swedish to Czech could be good job. Here is some of my key ideas from this paper.

Key words for everybody working with Ski Sweden:

- Feel good
- Joy
- Own responsibility
- Attitude and self confidence
- Openness, ambition and professionalism
- Loading
- Continuity
- Progression in training

"Our sport should have positive joyful atmosphere where everybody who takes part should have possibility to develop as human beings"

Good way to work with goal setting on any level is to set following questions:

1. What is my goal?
2. What are the requirements to reach this goal?
3. What input is needed reach these requirements?
4. What i need to do to get to put this input?

Five stones to build a success:

Safe social environment,
for athletes, find people that you feel safe and happy with, for leaders/coaches, be supportive not forcing

Motivation
Sport needs motivation. Ask yourself why are you doing this.

Joy
Motivation is many times together with joy. Spread joy and happiness around you.

Good self-esteem
This means persons idea about himself. You are worth the same whatever the result.

Self confidence
To have fun and positive atmosphere it is needed to trust that you can reach your goals.
Goal setting is very important when developing self confidence.

What you also need is:

Self awareness
The best athletes are very good in analyzing themselves. They know their strong and weak points and keep actively finding a way to develop themselves.

Autonomy
We as people want to make own decisions. For athlete it`s good to use coaches, parents, waxers, leaders advice, then make own decision and take responsibility of own actions

Lot of longterm training
It needs many hardworking years to make it to top in cross-country skiing.

Important ideas for 13-16 years of age

1. Make 2-3 hard trainings (A3, means higher from ANP) per week
2. Train often every week. Vary trainings a lot. Live active physical life.
3. Work with technic. Every training should have skill, coordination, balance and technic inputs.
4. Learn proper strength training techniques. Many short strength trainings.
5. Have fun!

Age	Moving hours	>85% max HR	<85% max HR
(17–18years)	450-550 h	10-12 %	Ca 90 %
(19–20years)	>550 h	10-12 %	Ca 90 %
(21–25years)	>650 h	8-10 %	Ca 90 %
26years–	>700 h	Ca 10 %	Ca 90 %

	Average week (h)	Endurance trainings	>85%max HR	<85%max HR	Strength	Speed
(17–18years)	Ca 10 h	5–7	>2–4	3–5	2	2–3
(19–20years)	Ca 12 h	6–8	>2–4	4–6	2	2–3
(21–25years)	Ca 14–17 h	7–9	>2–4	5–7	2	2–3
26years–	Ca 14–17 h	7–9	>2–4	5–7	2	2–3

In this table you can see big difference in idea of i1 compared to Norwegians. Swedish think it is better not to put athletes down in trainings that A1-A2 playing is good training. Also every Finnish medalist i know trained with very high I1 speeds when they were under 20-22 years of age. As a senior it comes down a little bit as a HR and compared to maximum speeds.

Here is link to this file:

https://www.skidor.com/globalassets/langdakning/dokument/utbildning/bla_gula-va_gen_20110926.pdf

7 Conclusions and suggestions

My main ideas for the Czech cross country skiings future:

1. Make supportive and joyful atmosphere. This is everybody`s responsibility. It is good to start by communicating.
2. Start with maximal strength training. You are way behind in this.
3. Start with speed training. Modern skiing is more and more about speed not only endurance. Make kids ski roller ski races again, like when Koukal and Bauer was young.
4. Make more hard trainings on skis and roller skis and also in double poling. Upper body power has high potential for development.
5. Set goals. Federation, clubs, coaches and especially athletes. Set goals and work to reach them.
6. Follow training process. Make routine checkpoints and tests how your shape is going every month, every year. After few years it starts to look sensible.
7. Trust yourself! Czech is a great sport nation. Bezecke lyzovani will be back on top.