Wanted: Easy Riders
The Aging of the German Motorcycle Rider Population and its Implications on the Motorcycle Market

Version from 14.07.2006

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Introduction

The aim of this paper is to build a framework of the motorcycle business in Germany, which can be used to construct a quantitative System Dynamics (SD) simulation model thereof. The problem to be examined is the superannuation and further aging of the motorcycle rider population in Germany and its influence on the whole market. We have chosen to concentrate on Germany – the second largest European motorcycle market (Eurostat, 2006) – as it is representative of most other developed motorcycle markets. Those lag behind developing markets in total market volume but are important as they drive the technology that eventually filters down to smaller models - generating volume in developing markets.

We will briefly describe the problems facing the motorcycle industry first. In the following section we will look at the significance of preserving a vibrant motorcycle industry. The decision to remain at a qualitative level will be explained and discussed next. Following that we will develop the Causal Loop Diagram of the problem in a step by step, walkthrough fashion. A discussion of the cohort effect generally will follow. Finally we will propose possible levers for change and point to where further research should lead.

Problem

An important problem facing the motorcycle industry in developing is an aging pool of motorcycle riders (Koch, 2005). In spite of unmistakable trends, many industry captains still doubt that this is of any importance (Brendicke, 2005; von Tschirschnitz, 2005). They point to full order books, record profits and record numbers of motorcycles in most of the important markets (Eurostat 2006; Brendicke, 2005; von Tschirschnitz, 2005).

As passing the motorcycle driving test after the age of 28 is unlikely (Schroeder & Schroeder, 2005) an aging rider population with small inflows is problematic for the long term sustainability of the industry.

The long time delays involved in the system – currently over 20 years from passing the license to being an attractive customer with sufficient disposable income (Koch, 2005) make the recognition of the problem even more difficult. The current rider pool is still well stocked with riders who were initiated into the motorcycle world before the 80s, when barriers to entry were low and the attractiveness of entry high. In addition the upper retirement / death age is being pushed further and further – to beyond 85 years (Koch, 2005). These two factors combined provide a sufficient buffer for the industry, in case action is swift. If that is not to be the case, the number of riders might well drop below sustainable levels.

A model of this problem is called for, first of all to verify that motorcycle users underlie the cohort effect (Koch, 2005), secondly to find potential solutions for the problem. If the cohort effect is confirmed to exist in this market, it is of utmost importance to act quickly and to choose the correct levers for action. Similar cases – such as that of the classical music industry – which have not been tackled sufficiently quickly, are in danger of terminal decline / disappearance (Hamann, 2005).

Furthermore the German market was chosen for several reasons. It is one of the richer markets in Europe and the one with the largest population (Eurostat, 2006). In addition it is the second largest motorcycle market in Europe, both in current sales levels and in absolute stock levels (Eurostat, 2006)[1]. It is also one of the markets, where the threat has at least partially been recognized, providing prior research to build on. Eventually our analysis is to expand from the German market to the whole of Europe.

Drawing a distinction between various kinds of motorcycles[2] / brands is not deemed helpful at the moment. The problem seems to be equally severe regardless of the category of motorcycle; additionally bikers see themselves primarily belonging to the group of motorcyclists (Schroeder & Schroeder, 2005) with further distinctions having a much lower importance. Furthermore the choice of motorcycle is subject to the ageing effect (Orth & Sorg, 2006b) as opposed to the cohort effect, therefore not a “problematic” subject from the point of view of this study.

So What?

Why would the common man be interested in preserving an industry and culture that many do not identify with, worse even fear or actively dislike?

The reasons are mostly not sentimental in nature. While preserving the various biker cultures is a worthwhile goal in itself, the demise of the industry would have several other repercussions. In developed markets motorcycles are a leisure activity first and a means of transport only seldom (Blenk, 2005; Charles, 2002).
Developed markets (from a motorcycle point of view) drive technological innovations, which filter down to the lowly scooters eventually (Orth & Sorg, 2006a). On the one hand those lowly scooters still represent a significant proportion of the world’s means of transport. On the other hand they are sold mostly in developing markets, at a paper thin profit margin. Therefore it is important that manufacturers have the possibility of including technology paid for elsewhere (Orth & Sorg, 2006a). This technology transfer improves the quality of transportation globally and to a smaller extent reduces the ecological burden of transportation.

[1] The motorcycle density – number of motorcycles per 1000 inhabitants – is a good European average at 45 (Eurostat, 2006).
[2] Cruisers, sports bikes, naked bikes, enduros, etc.

Some of the motorcycle high tech eventually finds its way into cars as well. In addition a functioning motorcycle industry provides a pool of skilled workers, a healthy and not insignificant supplier base, employment etc. And last but not least the motorcycle is the only chance for the common man to experience sinful speeds and acceleration for affordable money[3].

Qualitative Analysis – A First Step

How to proceed? One further goal of this work is to show the natural complementarities between 'quantitative' and 'qualitative' approaches. In a first step the demarcation of the problematic situation of the aging population of motorcycle riders – along with its possible effects for the market – are presented in this article. Several insights are gained from the causal loop diagram, which constitutes the basis for the next stage. In addition to presenting this basis this article also addresses important shortcomings of this pure qualitative model, which will be underlined in order to prepare the second step: a System Dynamics simulation model. The quantitative model is already under development and will be presented at a later stage.

SD is a field that is committed fundamentally to answering *why* questions (Sterman, 2000). A suggested way to meet this goal is making the most of the SD approach, which includes both the development of causal loop diagrams and the building of computer simulation models. The possibilities of communication and group work, the smoothness for identifying main issues (e.g. avoiding the risk of loosing insight because of incidental misleading quantification nightmares), are advantages not to be overlooked (see e.g. Coyle 2000). In turn, limitations of representation are also indicated since information and material can not be distinguished. Accumulations, for instance – a source of delays and therefore an important determinant of dynamics – might be easily overlooked with a CLD. The inability of addressing dynamics, the counterintuitive results associated with nonlinear feedback loop structures and the broad advantages of policy and general model testing processes are aspects that can only be addressed with a computer simulation model (see e.g. Homer & Oliva, 2001).

In our case, the pervasive delays at the macro level associated with the aging of the population imply the need of simulation, if we want to make any concrete recommendations. The CLD enables us to articulate the problem and to develop initial hypotheses, which are to be tested later on with the simulation model. The development of this understanding and the formulation of the hypotheses are the main points to be presented in this paper. In particular, the formulation of key variables, the discussion of the relevance of some of them (boundaries of the model), and the identification of feedback loops, are developed in this article. In

[3] Where it is permitted and safe – preferably at a closed circuit.

the end, the reasons for building the simulation model are obvious. After all, at the core of SD is the concept of dynamic hypothesis (Sterman, 2000), where relevant behaviors are associated with internal structures in order to provide understanding, and therefore, answer *why* questions. This brings us to the presentation of the basis – the CLD.

CLD Development

In this section of the paper we will develop the causal loop diagram (CLD) of the problem. We will proceed in a walkthrough fashion, discussing several important modules first and then linking them together into a complete CLD. We will start with the attractiveness of motorcycles as a means of transport, continue with their attractiveness to fill our leisure time, discuss the determinants of the rider pool, then assess the effects on the motorcycle market and finally devote some thought to the barriers to entry. A concluding section will link all of those together.

Motorcycle as Means of Transport

When motorcycles first appeared on the scene in significant numbers in the first decade of the 20th century, their primary objective was to provide a faster and more comfortable means of transport than the bicycle and the horse. This objective is still of importance to varying degrees in all markets. Later on the car emerged as the main alternative in developed markets – in the 1920s in the USA (Walker, 2002) and in the late 1950s in Germany (Blenk, 2005) and in the UK (Walker, 2002). Public transport increased in importance as well. Still, every motorcycle still has the capability to transport people from A to B – this remaining part of its role. How well motorcycles fulfill this role compared to substitute means of transport depends on several variables, including climate, the relative costs of motorcycle transport, safety, and other, softer factors – as depicted in Figure 1. We shall analyze the effects of those on the attractiveness of motorcycles as a means of transport in this part, starting with a description of the factors and then continuing with a CLD of this sub-sector.

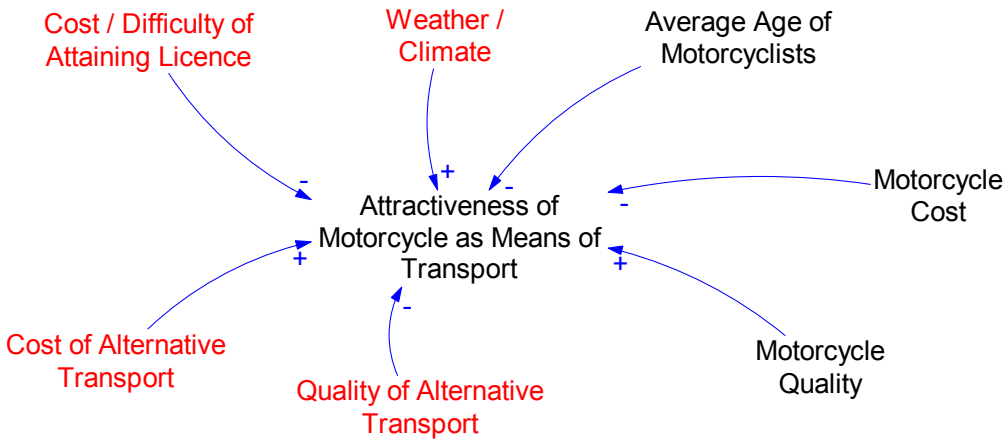

Figure 1 – Factors influencing the Attractiveness of a Motorcycle as a Means of Transport

Climate

Climate undoubtedly influences the attractiveness of riding a motorcycle as a means of getting from A to B when compared to its substitutes. It is intuitively appealing that countries with milder, drier climates present fewer obstacles to using the motorcycle compared to places with strongly pronounced winters and a lot of rainfall. Italy for instance has the highest number of motorcycles of all European countries (Eurostat, 2006). The density of motorcycles per 1000 inhabitants shows a similar picture – 70 for Italy, 88 for Greece, but only 10 for Iceland, 19 for Norway and 21 for Sweden (Eurostat 2006, see also the Appendix). Of course these data do not show the whole story, as there are significant other effects present, the trends are quite correct, however.

Motorcycle Quality

The next factor influencing the attractiveness of a motorcycle as a means of transport is motorcycle quality. By that term we encompass reliability as well as aspects brought about by technology – safety, creature comforts, speed, longevity…

Reliability is an important factor. When the riding has a specific transport purpose[4], namely getting to work or some other place at a predetermined time, one considers the likelihood of actually getting there of some importance. Clearly technological advances have increased reliability significantly. Compared to the car, a motorcycle still employs little electronics, which is prone to breaking down.

[4] As opposed to the next section, the Attractiveness of riding, where riding the motorcycle is a goal in itself

Therefore we are not yet at a stage, where technology on the one hand improves, and on the other one diminishes reliability (Riedel, 2006).

Safety as a criterion in decision making is also increasing in importance (Haasper, 2005). Here the motorcycle is traditionally worse than the car, the current German data providing a ratio of 28 motorcyclists compared to 9 car occupants dying annually for every 100000 vehicles (Sponsel, 2002). Sadly, motorcycle accidents and fatalities have not decreased at the same rate as car accidents / fatalities. As already mentioned, many technological advances[5] introduced in cars are missing (Riedel, 2006). On the other hand a motorcycle, given its 2 wheeled no crumple zone nature, will probably never be able to provide comparable passive safety[6] to a car. Still, developments are underway to increase the safety of motorcycles as well - with significant improvements in brakes and passive safety (Honda is to install the first motorcycle airbag from 2006 on).

Another factor significantly influencing the quality of a motorcycle as a means of transport is creature comforts. For motorcycles this primarily involves comfortable seating, good wind deflection, rain protection etc. Motorcycles have made almost no progress in this area until the arrival of the Vincent Black Prince in 1955 (Heil, 2005). Scooters introduced weather protection earlier, in 1947 (Heil, 2005). This was a major step ahead for the motorcycle, when considered as a means of transport. While arriving to work muddy might just about be accepted at a construction site, most other jobs have more stringent dress / cleanliness codes, ruling the motorcycle out prior to the arrival of this improvement. Some newer developments, such as the BMW C1 or Benelli Adiva 150, even add a roof, a proper car like seat and safety belts. Both try to capitalize on an inherent motorcycle quality – small footprint – while adding car like features of comfort.

This brings us to the final motorcycle quality as a means of transport to be discussed here – size. As opposed to cars, motorcycles have only two wheels, making them significantly narrower. In addition they are much shorter as well. This brings advantages in parking, which is a real consideration in crowded inner cities. It also means that traffic jams are negotiated easier and that they present a smaller hindrance than they do for car drivers. This gives motorcycles a valuable speed advantage in most traffic situations nowadays[7]. In modern congested times this is one of the main assets that a motorcycle possesses, which no car can match (Brendicke 2005).

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[5] Anti Blocking System (ABS) brakes are almost universally installed in cars, whereas few motorcycles can boast them, Electronic Stability Program (ESP) driving aids and xenon headlamps not having made an appearance in the motorcycle world yet.

[6] Passive safety is measured as the features protecting vehicle occupants when a crash has taken place, whereas active safety measures the features preventing an accident from occurring in the first place.

[7] This should not be seen as an attempt to praise irresponsible driving. The shorter journey times are possible while observing all traffic laws and regulations of the given country.

In addition motorcycles on an average consume less fuel and as a result pollute less. The cost aspect of this will be handled later, there is an ecological aspect as well, though, which belongs under the “quality” banner here. While the exhaust regulations are not as stringent for motorcycles as they are for cars[8], the much lower weight and fuel consumption mean a smaller ecological footprint on an average.

This gives a brief insight into factors subsumed under the motorcycle quality in the CLD. These, of course need to be compared to those offered by alternative means of transport, to see what attractiveness the motorcycle possesses in various markets.

Quality of Alternative Transport

In this part we will examine the different qualities of other means of transport that we consider substitutes for a motorcycle. As the motorcycle is mostly used either as a commuter or as a means of transport over short to medium distances, the examined alternatives do not include air or ship transport. The alternatives examined will be the bicycle, car and means of public transport.

The first criterion used for the motorcycle – reliability – is difficult to compare generally. Bicycle transport can usually be considered more reliable than any of the alternatives. Factors such as traffic or mechanical breakdowns are extremely unlikely to significantly influence the arrival time.
When looking at the car as a means of transportation, much about the reliability depends on the car pool in the specific country. Generally well maintained cars of a decent age are not particularly prone to breakdowns. In countries where maintenance is not scheduled but on demand[9], the reliability is lower but then so it will be for motorcycles as well, since the attitude towards maintenance tends to be a cultural issue.
The reliability of public transport is also strongly country dependant.

The safety of cyclists is theoretically comparable to that of motorcyclists. They do however travel at lower speeds on an average, meaning that any accidents are probably less tragic. In addition they enjoy the benefit of special cycle routes in some countries, not needing to travel on normal roads, reducing the risk even further. They tend to be better protected legally as well, which makes other road users a bit more careful towards them than towards other cars or motorbikes.
Cars enjoy much better passive safety than motorcycles. Their size and shape allows the building in of crumple zones, the use of innovative restraint systems, airbags etc. As already mentioned, the number of annual fatal accidents in

[8] Currently only Euro 2 is asked of newly built motorcycles in Europe, with Euro 3 being the norm from 1.1.2007. For cars a much stricter Euro 4 is in place already since 1.1.2005. However cars not meeting the norm are still sold, only taxed more heavily.
[9] Maintenance is not done preventively, at predetermined time / mileage intervals but only when something actually already broke down.

Germany is less than one third of that for motorcycle rider per 100000 vehicles (Sponsel, 2002). Public transport enjoys an even better safety record, in spite of negative publicity in some countries.

Bicycles generally offer a comfort equal to or lower than that of motorcycles. In addition to exposing the riders to all the elements, they require work to operate. Cars, on the other hand offer weather protection, heating and increasingly air conditioning as well. They tend to be quieter, allow the occupants a more comfortable seating position and in some cases really pamper them[10]. The comfort of public transport is very country dependant and can range from excellent to very poor.

Finally the speed aspect is connected to the density of traffic. In urban centers motorcycles will beat other means of transportation due to their small size and ability to pass standing traffic – cars and buses / coaches. The latter partially have bus lanes available to them, which negates the advantage of motorcycles to some extent. Rail based public transport usually doesn't have to compete for the "traffic space" with other vehicles, therefore not being affected in a major way by traffic. The shortcoming of public transport in crowded areas is that a heavy load on it either means a decrease in comfort for the passengers, or delays due to insufficient capacity. All public transport also has the disadvantage of not being constantly available on the one hand, and not of a door to door type on the other. This makes it less attractive compared to personal forms of transport.

The factors examined show that there is no clear advantage that any means of transportation may claim for itself generally – all being contingent upon the situation. Here a simulation model will definitely help determine the relationships for a given area of interest.

Motorcycle Cost

In this section we are going to quickly go over the costs of operating a motorcycle. They do not only include the purchase price but also maintenance, registration, taxation, insurance and other running costs, such as fuel. Generally the motorcycle fares fairly well in this respect, being the preferred choice of transport in areas with a lower living standard (Blenk, 2005; Walker, 2002).

The cost most easily obtained and most pertinent initially is the purchase cost. The entry into the motorcycle world[11] in Germany starts at just below 1400 EUR and extends to 40000 EUR for exotic machinery like certain Boss Hoss or Bimota models (Soppa & Riedel, 2006). The vast majority of motorcycles offered, even in a well off society such as Germany is priced under 15000 EUR (Soppa & Riedel,

[10] Air conditioned seating with massage function, double glazing, air suspension etc. are no longer restricted to the most extravagant cars only.

[11] 125ccm and above, motorcycles of a lower displacement do not need to be registered, hence not counted in the statistics. Prices are for new motorcycles.

2006). In sales numbers this is even more pronounced with bikes exceeding this price making up less than 5% of the market (Orth & Sorg, 2006b).

As the value of a motorcycle is lower, so are the insurance premiums. Some types of motorcycles are especially likely to be involved in accidents – super-sports bikes – or especially well liked by criminals – Harley Davidsons for instance. These then are costlier to insure but still relatively cheap when compared to a car.

The maintenance costs per kilometer vary widely amongst the various motorbikes. The more exotic machinery is significantly more expensive to maintain than a car would be[12]. On the other hand there are still many motorcycles that anyone with basic mechanical prowess can maintain him/herself.

The fuel consumption of a motorcycle is generally below that of a car (Soppa & Riedel, 2006). If one factors in that car sharing is still rare and that most car journeys do not involve more than one person, this can be seen as a cost advantage. When fuel is divided over more occupants the car gets increasingly competitive.

Cost of Alternative Transport

The bicycle is of course cheaper to run and purchase than a motorbike. It only needs a well fed rider to propel it, maintenance is minimal and in most countries there are no taxes / insurance premiums to be paid for it.

As already mentioned cars come off slightly worse than motorcycles, when the costs are divided over a single occupant. Were the policies that encourage car sharing to bear fruit, this could be reversed. Some costs are hard to keep in check for cars, though. Modern cars almost universally cannot be maintained by an even very skilled user anymore.

The cost of public transport varies significantly as well – from free to non competitive.

Average Age of Motorcyclists

While getting older may not hinder motorcyclists from using their bikes generally, there seems to be a trend towards reduced use with age (Koch, 2005). This especially applies to the transport role, especially since the motorcycle is generally not as comfortable as most other forms of personal transport. In

[12] Motorcycle engines are subject to higher stress generally, since they operate at much higher revolutions – up to 17000 RpM for some street legal bikes, whereas there is no road car currently on the market that would exceed 9500 RpM. These stresses require more exotic – expensive - materials and necessitate shorter service intervals.

addition older people – and a significant proportion of the bikers in Germany is retired (Koch, 2005) – have reduced needs for commuting.

The last factor identified with a major influence on the motorcycle as a means of transport is the cost / difficulty of obtaining the motorcycle license. This will be discussed in more detail in the Barriers to Entry section.

The relative importance of the factors listed and the values they take in a given market will determine how important the motorcycle is for pure transportation purposes. While literature points us to the diminishing importance of this role (Walker, 2002; Charles, 2002; Blenk, 2005), further quantitative research in the area is required. The rebound of the motorcycle industry in the 1980s and 1990s has had little to do with newly arisen transportation needs and a lot more with a reinterpretation of the motorcycle as a lifestyle object, to be discussed in the next section.

CLD of Motorcycle as a Means of Transport

These factors are integrated in a causal loop structure Figure 2 below.

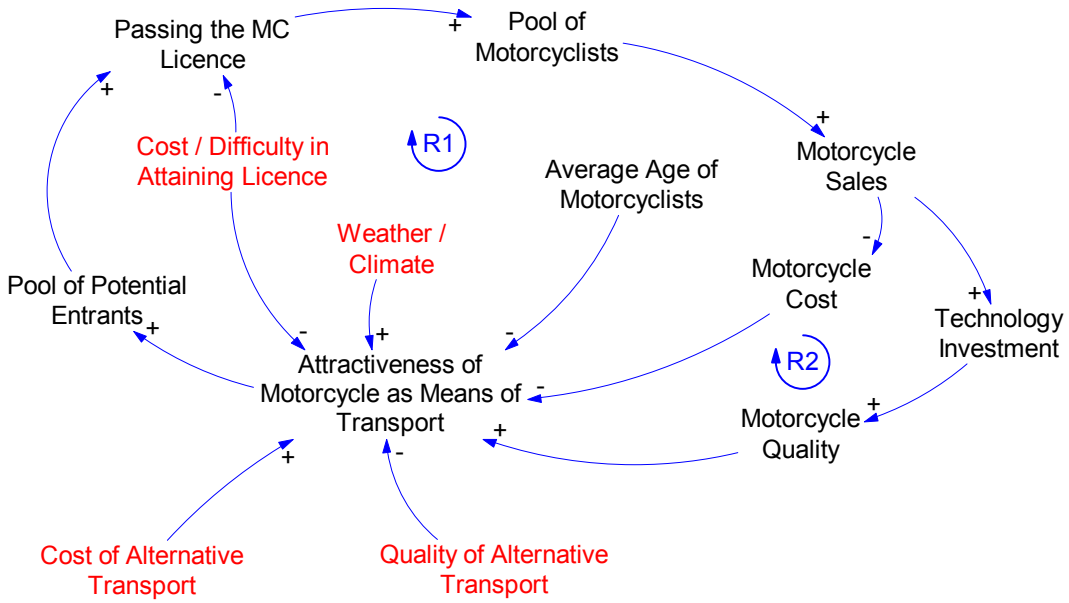

Figure 2 – CLD of the Motorcycle as a Means of Transport

The CLD includes two reinforcing loops R1 and R2.

R1, the Motorcycle Cost Loop, means a higher pool of potential entrants with a rise in attractiveness of the motorcycle for transportation, which in turn means that in otherwise unchanged circumstances more of those potentials actually

manage to pass the license and become motorcyclists. The pool of motorcyclists is one of the factors influencing motorcycle sales, in a supporting fashion. An increase in sales leads to reduced costs per product sold, both through spreading fixed costs over a larger number of products and by scale effects in production as well as the after sales support infrastructure. Finally, costs movements have an opposing effect on the motorcycle attractiveness, completing this first reinforcing loop.

R2, the Motorcycle Quality Loop, follows the trajectory of R1 up to the motorcycle sales point. Increasing sales, in addition to the factors mentioned above, also mean the possibility to invest more money into new technology[13]. This technology investment will drive motorcycle quality.

As the attractiveness of the motorcycle as a means of transport is in decline, factors relating to the use of it as a leisure activity will likely be more important and are presented next.

Motorcycle as Lifestyle Article[14]

The first time when the motorcycle became primarily a leisure activity came shortly after the Second World War. The large demand for workforce primarily in the UK resulted in many under 18s – who were still living at home – suddenly having unused funds at their disposal (Charles, 2002). At the same time the teenager was born – not yet an adult, no longer a child[15] (Charles, 2002). Teenagers sought actively to differentiate themselves from adults and the motorcycle culture, together with rock 'n' roll was born. It is difficult to accurately assign the start up signal to either the USA or the UK. While the former undoubtedly provided the cultural impulses[16] it was the latter that produced the machinery[17] to go with them.

The early image of a "biker" was rebellious; he represented an outlaw, beatnik, modern cowboy… (Walker, 2002; Charles, 2002; Quinn, 1991; Barger, 2000). Later on the "scene" diversified to include more socially acceptable forms as well as the Born to Be Wild[18] ones (Walker, 2002; Quinn, 1991).

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[13] Even with an unchanged investment strategy

[14] While care has been taken to find as many scientific texts for this part of the study as possible, works of fiction and biographies have been included as references as well. As this is the "softest" area of the whole model, where little scientifically collected data exists, we deemed the study of fictional literature of the subject matter helpful for understanding the motivations driving motorcyclists.

[15] According to Charles (2002) the switch occurred more suddenly, with the transition also being smoother in prior times.

[16] More literature on the cultural factors leading to the "motorcycle revolution" are quoted in Charles (2002) and Barger (2000).

[17] The UK was the most important motorcycle manufacturer from WW2 to the 60s (Walker, 2002; BCG, 1975; Mair, 1998; Quinn, 1991).

[18] The Steppenwolf Title song to the Easy Rider movie.

The reasons for choosing a motorbike and "biking" over other forms of leisure or as a lifestyle are manifold. They involve lack of satisfaction and identification with society (Charles, 2002; Pirsig, 1984), the absolute thrill of speed (Wendmann, 2004; Milosevic, 2005), being one with the "perfect vehicle" (Holbrook Pierson, 1997) and also very importantly, group belonging (Walker, 2002; Charles, 2002). The factors influencing whether one will choose to take the leap and pass the test are listed in Figure 3 below and will be described in some more detail in this section.

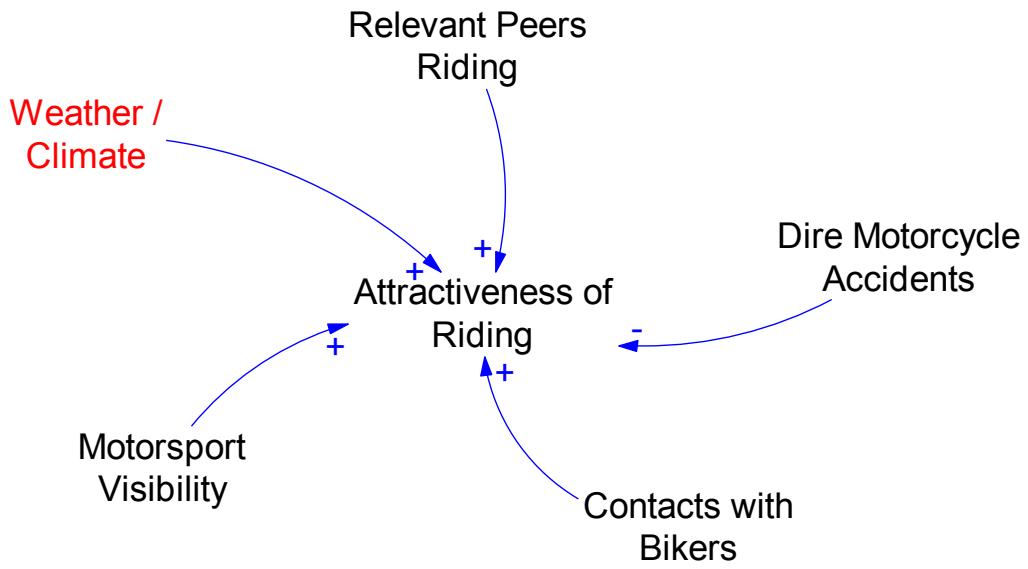

Figure 3 – Factors Influencing the Use of a Motorcycle as a Lifestyle Activity

The motorcycle and motorcycling are no longer in the centre of societies' attention these days (Fisher, 2005). The fact that motorcycle advertising is very restricted financially[19] – meaning that most of it is in motorcycle magazines – means that it is mostly available to people interested in motorbikes already (Schroeder & Schroeder, 2005; Hagstotz & Schmitt-Hagstotz, 2005). The youth of today still shows a strong latent interest in motorcycles, with about a quarter being interested in Germany (Fisher, 2005). So the possibilities to bring about their initiation into the motorcycle world are the following:

- contacts with bikers
- the existence of a relevant peer group already "riding"
- motorcycle motor sport visibility.

[19] Only 18.1 million EUR for the entire motorcycle advertising in Germany in 2002 (Hagstotz & Schmitt-Hagstotz, 2005)

Contacts with Bikers

The first and most important mechanism initiating someone into the motorcycle world is to have contact with someone already in there. Those can be parents, friends (peers) or people unknown to the subject, such as riders seen on the street. Initially it is the parents who exercise the greatest pull on the desires of youngsters, later on this switches to a relevant peer group[20]. Contacts with bikers are especially important in today's world, where youngsters no longer associate the motorcycle with cool – making them instinctively seek out further contact – but where the motorbike is associated with old men wearing funny leather clothing, or even worse parents embarrassing one in front of peers (Schroeder & Schroeder, 2005; Pirsig, 1984). An ample pool of bikers is therefore necessary to ensure that at least some youngsters will have a positive experience with the idea of "biking", making them seek entry into the motorcycling world.

Relevant Peers Riding

As already mentioned, even an ample pool of motorcyclists might not do much to incite a youngster to become fascinated with the product, if the pool is composed primarily of people, our potential convert cannot associate with. A rapid decrease in the numbers of motorcyclists under the age of 25 (Koch, 2005) should therefore be a wake-up call for the industry.

The existence of a relevant peer group amongst the motorcyclists is not only of interest for new entrants, though. Even existing bikers are likely to ride more often, when there are many like minded people available in the vicinity (Walker, 2002; Wendmann, 2004) – as biking is after all a social activity.

Motor Sport Visibility

In countries where the motorcycle motor sport is both actively practiced and present in media channels, the likelihood that motorcycle riding is going to be attractive to new entrants is higher. A case in point is Italy, where Valentino Rossi not only drives motorcycle sales but is a true legend in all walks of life. A figure like that can make a massive difference to the influx of new entrants (Koch, 2005). In addition to being unbelievably successful, he represents an image that the young population of today can identify with (Schroeder & Schroeder, 2005). Sadly no German TV channels cover motorcycle motor sport events.

Dire Motorcycle Accidents

While the three prior factors discussed all contributed to a positive image of motorcycling and reinforced entry, this one acts as a brake. As discussed below,

[20] For a detailed analysis of the influence of elders versus peers see Hamann (2005) and the literature quoted therein.

the abundance of dire motorcycle accidents will dampen the enthusiasm the younger population might have towards the product. The risk used to be part of the thrill for the “Born to Be Wild” generation but is a definite turn-off for today’s youngsters (Schroeder & Schroeder, 2005).

Climate

The climate has a similar effect on the attractiveness of motorcycling as a lifestyle proposition, as it has on the motorcycle as a means of transport. The effect might not be so pronounced, since it is easier to work around the weather situation if one can choose when to ride.

With two main reasons for entering into the motorcycle market discussed we will move on to the determinants of the motorcycle rider pool.

CLD of the Motorcycle as a Lifestyle Article

The CLD of this section with the next five loops is presented in Figure 4 below.

Reinforcing loop R3, the Increasing Entry through Contacts loop works from an increased attractiveness of riding increasing the pool of potential entrants. Similar to the mechanism in R1, this means an increasing number of people passing the license and filling up the pool of motorcyclists. The higher the number of motorcyclists, the larger is the probability that one comes into contact with them and the product. This means that non-riders have the opportunity to better assess what the product and its associated lifestyles entail and increases the attractiveness of riding generally.

Reinforcing loop R4, the Peers Loop, again works like loop R3 to the pool of motorcycles variable. An increase in the pool of motorcyclists not only means that one has more chance of meeting motorcyclists generally, but also the chance that people we consider our relevant peers will be riding. This will increase the attractiveness of riding, as a higher proportion of the relevant peer group performing an activity makes it more attractive. Not only will increase the number of potential entrants but also ensure that existing motorcyclists ride more.

Reinforcing loops R5 and R6 are the Motor-sport Attractiveness loops. R5 follows the same basic structure as R3 to the pool of motorcyclists. A higher pool of motorcyclists will on the one hand mean more motor-sport events, on the other hand a larger demand for their publicity, as the target population to watch the events will also increase. Both of those effects will have a positive effect on the attractiveness of riding, through bringing the product and lifestyle closer to the uninitiated. Loop R6 reinforces this effect through making it attractive for advertisers and publicity channels to be associated with the “desirable” product.

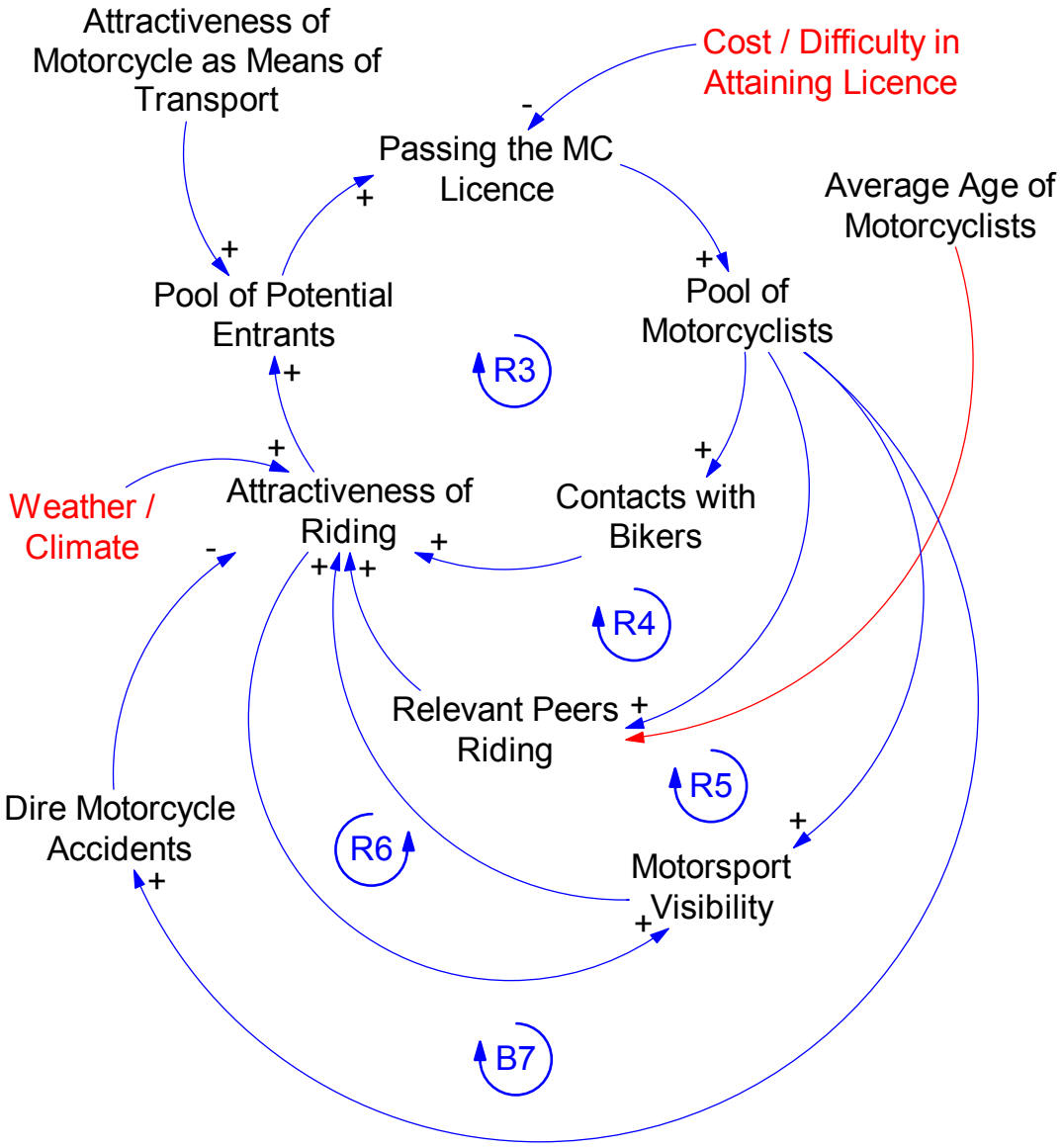

Figure 4 – CLD of the Motorcycle as a Lifestyle Article

Finally, balancing loop B7, the Dire Accident Loop, dampens the attractiveness of riding as a result of an increasing pool of riders. A larger pool of riders will mean more dire accidents, which have a very strong effect both on people wanting to become riders, as well as on their parents or significant others, who have an effect on allowing / enabling this wish to become reality. So the pool of motorcyclists is one of the most central variables and will be handled next.

Motorcycle Rider Pool

This is a relatively straightforward part of the final CLD. As with stocks generally there is an inflow and outflow of bikers, which determines the level of the stock (see Figure 5).

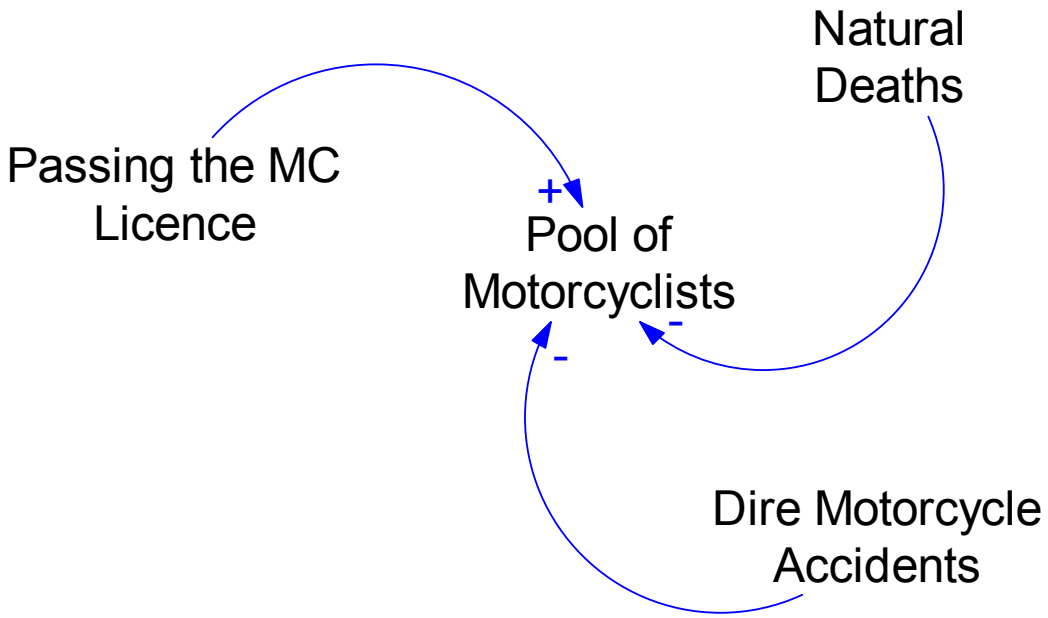

Figure 5 – Factors Influencing the Size of the Pool of Motorcyclists

The inflow is formed simply of people who passed the motorcycle driving test and obtained a driving license. In Europe a special motorcycle driving license is a legal requirement to operate motorbikes with engine displacements over 125ccm, in some countries even for the operation of motorcycles over 50ccm.

Riding a motorbike is a skill akin to riding a bicycle – acquired for life (Fisher, 2005). While not everyone in possession of a license automatically rides, the license does present a necessary condition for the entry into the motorcycle world and for the purchase of a motorcycle. As will be described in more detail later on, people are extremely unlikely to acquire a license after the age of 28 (Schroeder & Schroeder, 2005; Koch, 2005). This makes the existing pool of bikers so important for any motorcycle manufacturer. Namely the pool cannot be increased rapidly. Any increases in the pool will be comprised of young entrants, who have a lower disposable income and are therefore less interesting to the manufacturers in the short run.

As one acquires the skill and license[21] for life, the only exit from the pool is through death. Here natural death is equated not only with the grim reaper but also with a maximum age at which one is capable of riding a motorcycle. This is increasing (Koch, 2005) but cannot do so indefinitely due to our lifespan limits. Currently bikers older than 85 are present in statistically insignificant numbers but they may be better represented in the biker population by 2012 than under 21 year olds (Koch, 2005).

Another means of exit, which has to be taken into account are dire motorcycle accidents. Under the term we understand any accident involving a motorcycle, where the injuries are fatal or so severe as to prevent further riding / normal life. They deserve a special treatment, since they have wider repercussions throughout the model. They have a negative effect negative on the attractiveness of riding a motorcycle generally and decrease the pool of riders not only directly but through a feedback effect as well.

Motorcycle Rider Pool CLD

As Figure 4 already follows the feedback loops associated with the inflows into the pool of motorcyclists, here only the outflow loops will be presented (Figure 6).

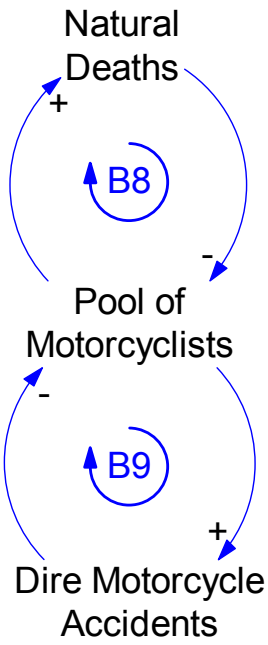

Figure 6 – Pool of Motorcyclists CLD – Outflows

The balancing loops B8 and B9 are fairly straightforward. B8 simply states that for a higher pool of motorcyclists generally will mean that at the same death rates

[21] In most cases at least. The situation might be influenced by illegal driving habits, however.

more of them will die. Dire motorcycle accidents in B9 are separated as they have wider repercussions within the model, beyond simply draining the pool of motorcyclists directly.

Motorcycle Market

Finally we are arriving to the section of interest to the motorcycle manufacturers – the components influencing the sales. There are for of them, as shown in Figure 7 – the disposable income of motorcyclists, the pool of motorcyclists, the desire for purchasing a new motorcycle and motorcycle attrition.

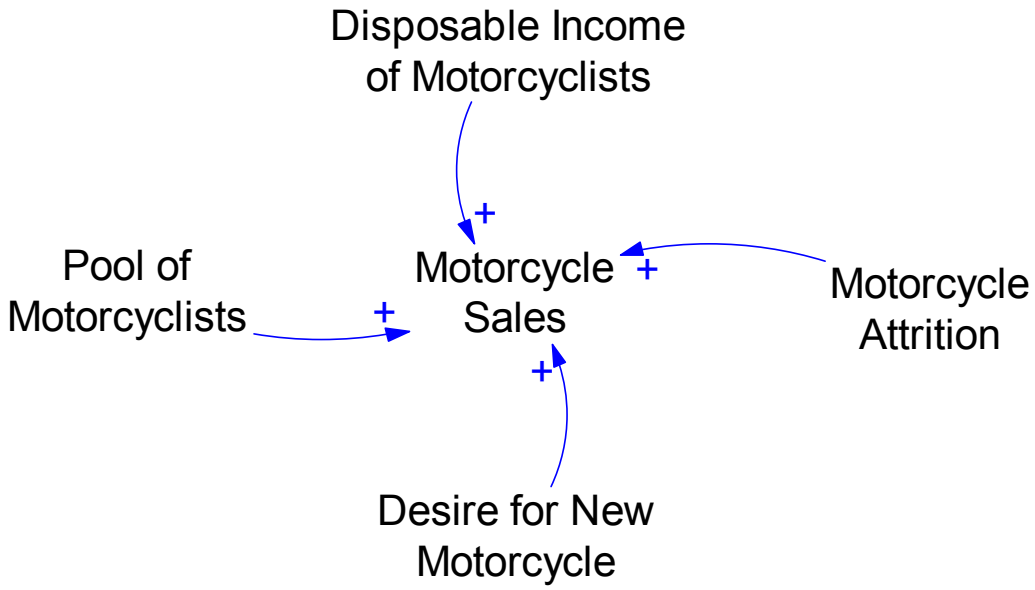

Figure 7 – Factors Influencing Motorcycle Sales

The relevance of the pool of motorcyclists is obvious – they are the ones purchasing the product. The larger the pool, the larger, ceteris paribus, the sales. On the other hand the composition of the pool – the average age of the bikers within it – is important as well.

The higher the average age, the higher – up to a point – is the disposable income of the people (Koch, 2005). This higher disposable income allows riders to purchase more expensive machinery, where the profit margin of the manufacturers is of course higher as well. Many manufacturers count on this sector of the market primarily, examples being BMW (von Tschirtschnitz, 2005), Ducati (Spira, 2005) and Harley Davidson. That is a dangerous strategy in the long term, though, as it doesn't ensure a pool of new entrants to replace the ones leaving the motorcycle system.

On the other hand older riders lose the desire for purchasing each and every new generation of motorcycles (Koch, 2005). This makes younger riders especially interesting for some manufacturers / sectors of the market, where the product lifecycle is 2 years on an average (Walker, 2002; Wendmann, 2004). The lack of young riders is already making itself felt in markets such as Germany, with the average age of the motorcycles increasing, sounding first alarm bells at the manufacturers' (Koch, 2005). The increase in the average age of the machines is a problem, since it means increasingly lower sales, while the total number remains constant or even rises slightly (Koch, 2005).

The final factor – motorcycle attrition – has to do with motorcycle quality as well as usage. The better the quality, the longer a motorcycle will last. On the other hand a more intensive usage will decrease the lifespan of a motorcycle. The assumption is that without changes elsewhere in the system motorcycles that are no longer fit for use are replaced on a more or less one for one basis.

Motorcycle Sales CLD

Here, in Figure 8, the final partial CLD is presented, with six further loops.

Starting with B10, a rise in the stock of motorcycles will mean that if their use is the same, more motorcycles will deteriorate over the same period of time balancing the increase of the stock.

R11 works in a similar fashion but focusing on the fact that an increased attrition, ceteris paribus will also bring increase sales for replacements. Which of the loops B10 and R11 prevails depends on whether the market is generally growing or not – as a result of the size of the pool of motorcyclists and their average age.

The loop 12, takes an effect on both B10 and R11 and can then overall be either reinforcing or balancing[22]. The movements in the stock of motorcycles, as already described in R1 will have an opposite effect on the movement of motorcycle costs. These again affect motorcycle use in an opposing way, which in turn has a supporting effect on the attrition. The loop can then be completed either through the stock of motorcycles directly or through the sales.

R13 again shows the effect of sales on technology from R2 but adds the effect from higher quality to lower cost (through maintenance, longevity, etc.). A quality increase will also decrease the number of dire accidents, through better controllability and active and passive safety (R14). Finally, as already mentioned, a decrease in dire motorcycle accidents will increase the use of the bikes by existing motorcyclists, therefore the attrition and sales.

[22] One could simply divide it into two loops but the authors deemed that brought little added clarity.

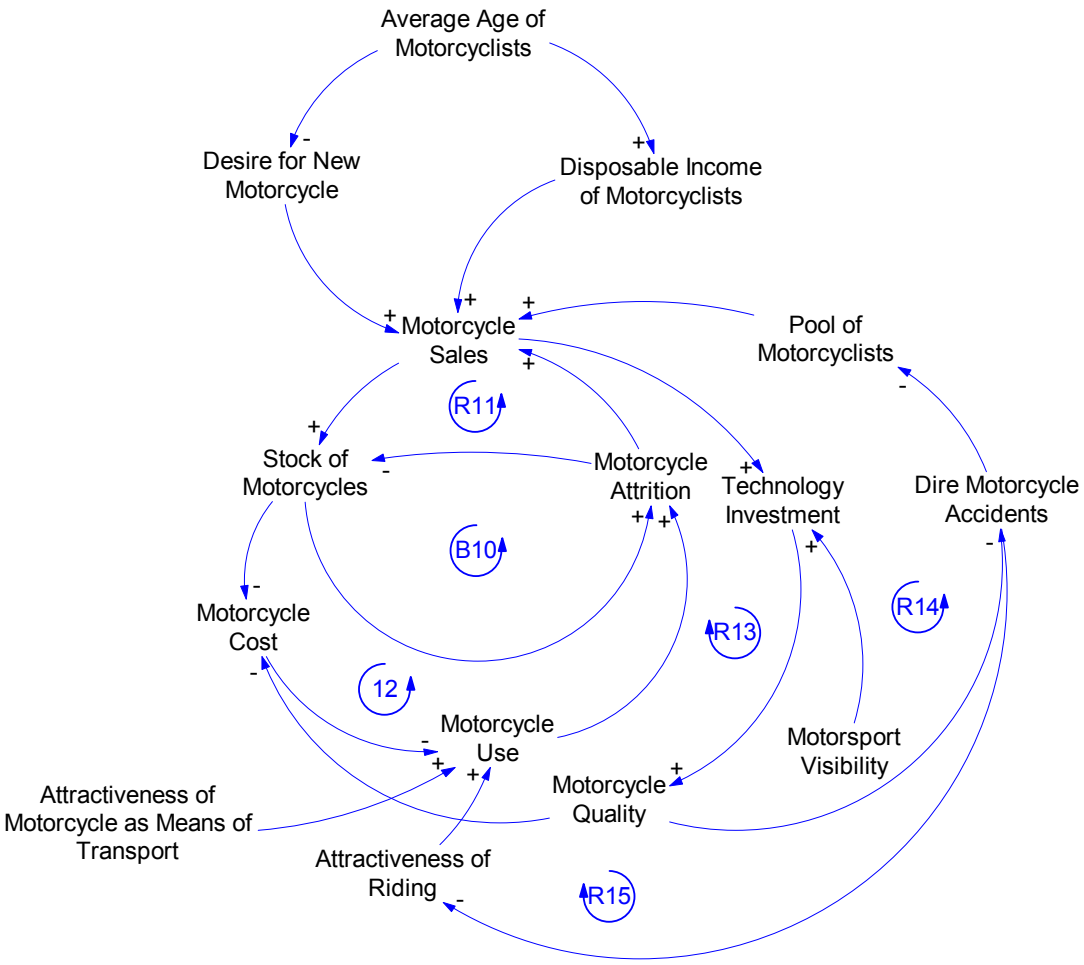

Figure 8 – Motorcycle Sales CLD

Barriers to Entry

The last area to be examined is that of entry barriers. This primarily revolves around the attainment of the motorcycle driving license. This barrier to entry did not exist for a long time – until the late 1960s most countries did not require a driving license for motorcycles at all (Walker, 2002; Blenk, 2005).

In the meantime the situation is one of endless complications. Many countries limit the displacement and power of motorcycles that a new driver may drive, and that for several years. This makes entry less attractive, especially since the models at the lower end of the displacement scale leave a thin profit margin for the manufacturers, who in return offer a poor product selection.

In addition to introducing the driving license, its price increased as well. While 1300 EUR might not prove a major obstacle for someone in the mid 30s or 40s, these are no longer relevant, since they are unlikely to enter the motorcycling

world. Youngsters seem to have many alternative uses for this money and obtaining a motorcycle license is often not one of them. In addition the standard of living has improved to an extent that many youngsters get a car very soon after they are able to drive one. Germany and some other countries in Europe are approaching or past 500 cars per 1000 inhabitants. This makes the investment into a car driver's license more sensible and often means that there is no extra money for the other one.

Countries where obtaining a motorcycle license is easier and cheaper, such as Switzerland, for instance, boast significantly more riders and motorcycles. In spite of a suboptimal climate Switzerland makes it to the absolute top in Europe – taking a second place after Greece (Eurostat, 2006a).

This allows us to piece the puzzle together to a complete CLD in the following section.

Missing Links

The Figure 9 below presents the complete CLD. Following that we will go into the missing links, variables not yet discussed.

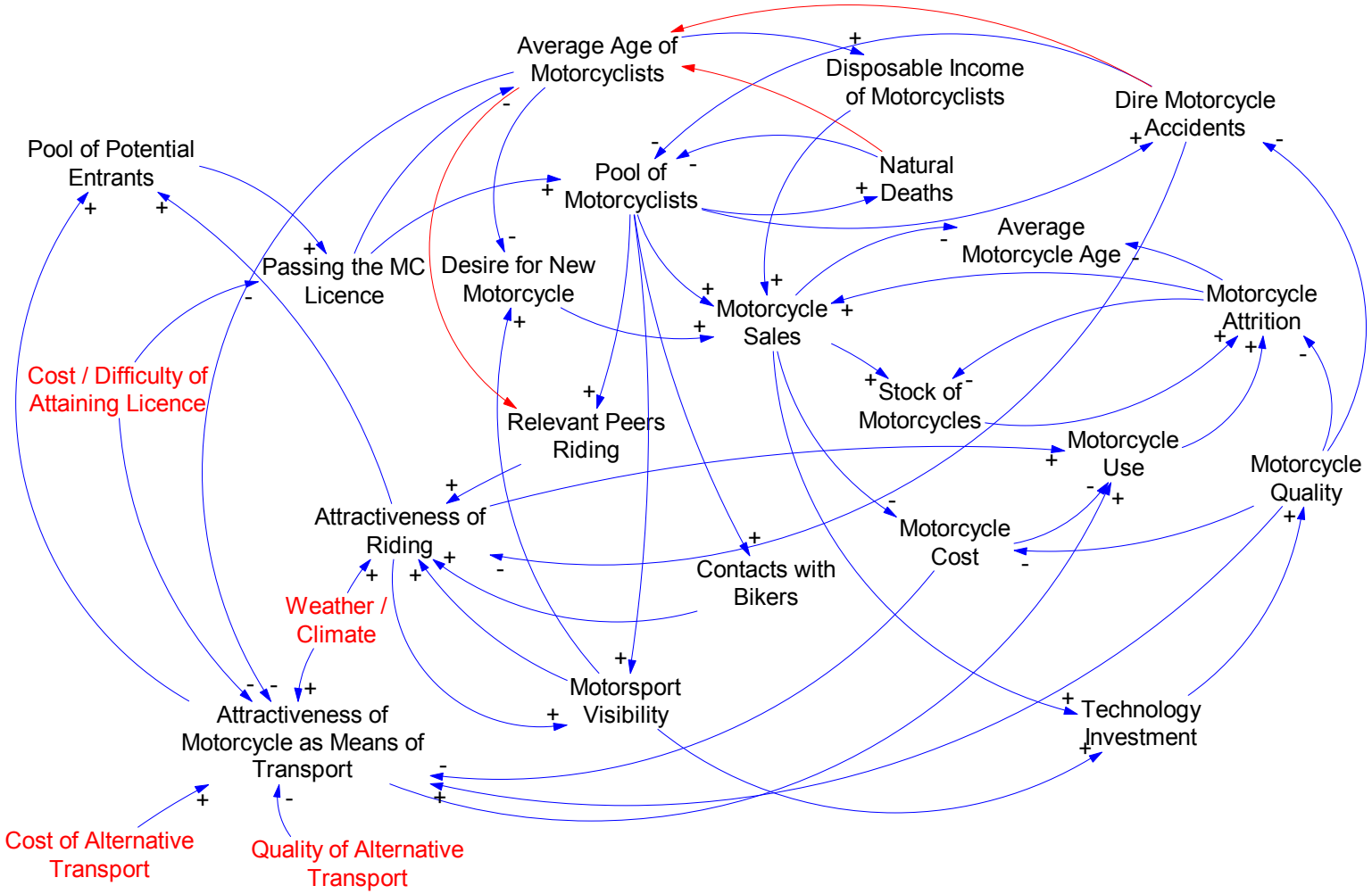

Figure 9 – Complete CLD

One variable not yet explained is the technology investment. Motorcycle sales on the one hand and motor sport visibility on the other influence it. The sales generate the necessary funds, which can then be invested into better technology. The visibility of motor sport has another effect. The higher the visibility, the larger the drive / desire to win. This might involve a better driver or the case interesting for us, better machinery through further development. In contrast to cars, where most racing series use vehicles with little relevance to the normal car, motorcycles used for racing are only a step away from the machines one can legally buy and drive on streets. Therefore the effects of racing are a lot stronger on the development of street technology than is the case for cars. The effect of increased investment into technology is of course better motorcycle quality, in all the aspect already described.

Both the average motorcycle age and the average age of motorcyclists are variables implicitly included in the other sections. In a CLD form it is impossible to determine the effect of deaths / dire accidents on the average age of the motorcyclist – they could decrease it or increase it, depending on circumstances. In the same way a higher average age might mean more or less relevant peers riding, depending on the population we are looking at. To differentiate those links, they are presented in red and have no effect sign at the arrowhead.

This completes the walkthrough of the model and brings us to the cohort effect part.

Cohort Effect

In this part we are going to examine the cohort effect more fully and to briefly look at its implications for the motorcycle market. Glenn (2005, p.2) defines a cohort as,

> *"a number of individuals who have some characteristic in common. Here and in other literature on cohort analysis, however, the term is used in a more restricted sense to refer to those individuals who experienced a particular event during a specified period of time."*

Furthermore, he defines two uses of the cohort analysis, the second of which – *"understanding the sources and nature of social, cultural and political change"* (Glenn, 2005, p.2) – is the one envisaged by us for this paper.

His warnings about the identification problem – namely age, period and cohort effects are statistically inseparable (Glenn, 2005) – are less pronounced when one attempts to tackle the issue of study using a quantitative SD model, which allows for accumulations and feedback / circular interdependence of variables (for a prior example of a SD model of a system with cohort effects see Hamann, 2005).

Our case is an excellent example of the cohort effect, namely people not obtaining the motorcycle driving license by the age of 28 – experiencing a particular event during a specified period of time – are unlikely to ever do so later (Schroeder & Schroeder, 2005).

On the other hand riders cannot legally enter the field until they are 16. Those two facts together mean that there are long time delays involved in any envisaged change in the pool of motorcyclists. As the attractiveness of a motorcycle rider to the industry increases with age (as a function of disposable income) any significant improvements are difficult to accomplish in the short run. The upside is that negative effects – such as a negative safety image – also take a long time to produce a significant effect.

What are the implications of this knowledge for a motorcycle manufacturer? First of all, older riders might bring in the money but without work on rejuvenating and continually refilling the pool of motorcycle riders the cash cows will die out (Koch, 2005). The Easy Rider cohort in the boards of motorcycle manufacturers will need to find an image as relevant to Generation X as Peter Fonda and Dennis Hopper on a pair of Harleys were to them.

Levers for Change

As already mentioned it is extremely difficult to determine the strength / effect of levers, which could influence the model dynamics, on the strength of a qualitative model only. As seen in Figure 5, there are only 4 dangles – variables entering the model from outside and not being affected by the model. Climate, the first one of those, can be influenced only in a weak way, and even then one cannot propagate global warming to save the motorcycle industry. The quality of alternative transport can be influenced, of course. Sadly – from the motorcycle industry's point of view – those with the levers to influence it have usually the interests of the respective alternative transport at heart, and not that of the motorcycle. The same goes for the costs of alternative transports. This leaves the cost / difficulty of obtaining a license as the only one, which can be significantly influenced. Whether working on this one alone would suffice, remains a question for the quantitative simulation model that is to follow.

The same conclusion holds for other, smaller levers, which cannot be portrayed in such a macro level CLD.

Conclusion

To conclude we have mapped out the problem situation, facing the motorcycle industry. This should serve as a first step for a simulation model, which will hopefully provide concrete answers to the problems being faced.

Even without the help of a simulation model we can conclude that the industry is in trouble, which will keep increasing in depth, if appropriate steps are not taken. The aging of customers in product areas, where a specific skill needs to be obtained in a given period in life in order to master it at all is a problem, which can be analyzed more successfully using SD than other, more conventional approaches – the shortcomings of which are described by Glenn (2005).

Another successful application of SD to a field with cohort effects[23] will definitely strengthen the position of SD as a tool of analysis for such problems.

[23] A successful application in the classical music industry sector already exists (see Hamann, 2005).

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Appendix

time	2002a00	2003a00	2004a00		Cars x 1000	Motorcycles x 1000	Cars/1000 Inhabitants	Motorcycles/1000 Inhabitants
Belgium	10332785	10376133	10421137	10376.13	4821	319	464.6239596	30.7436306
Czech Republic	10204853	10207362	10216016	10207.36	3706.012	751.634	363.0724569	73.63645965
Denmark	5375931	5390574	5404523	5390.574	1888	83	350.2409947	15.39724712
Germany	82488495	82534176	82516260	82534.18	45023	3745	545.5073544	45.37514253
Estonia	1358644	1353557	1349035	1353.557	400.7	7.2	296.0348179	5.319317916
Greece	10987543	11023514	:	11023.51	3840	970	348.3462714	87.99371961
Spain	41313973	42004522	42691689	42004.52	18733	1517	445.9757928	36.11515922
France	59678252	60027912	60380600	60027.91	29560	1091	492.4375847	18.17487838
Ireland	3931771	3995699	4068453	3995.699	1532	35	383.412264	8.759418565
Italy	57157406	57604658	:	57604.66	33706	4050	585.1262931	70.30681442
Cyprus	710338	722752	739771	722.752	302.501	14.296	418.5405229	19.77995218
Latvia	2338624	2325342	2312819	2325.342	648.9	22.9	279.055726	9.848013755
Lithuania	3469070	3454205	3435591	3454.205	1256.9	21.8	363.8753346	6.311148296
Luxembourg	446175	449950	453300	449.95	280.7	11.9	623.8470941	26.44738304
Hungary	10158608	10129552	10107146	10129.55	2777	103	274.1483533	10.16826805
Malta	395969	398582	401268	398.582	201.9	13.3	506.5457045	33.36829059
Netherlands	16148929	16225302	16281779	16225.3	6711	461	413.6132566	28.41241414
Austria	8083661	8121149	8173323	8121.149	4054	305	499.1904471	37.55626205
Poland	38230364	38204570	38182222	38204.57	11243.8	845.5	294.3051054	22.13086026
Portugal	10368403	10441075	10501970	10441.08	5788	387	554.3490493	37.06514894
Slovenia	1994530	1995733	1997012	1995.733	890	12	445.9514374	6.012828369
Slovakia	5379056	5379607	5382438	5379.607	1356.2	48.7	252.1001999	9.052705895
Finland	5200598	5213014	5228172	5213.014	2275	130	436.4078055	24.93758889
Sweden	8924958	8958229	8993531	8958.229	4075	188	454.8890188	20.98629093
United Kingdom	59327658	59568776	:	59568.78	26953	1181	452.4685886	19.82582284
Iceland	287523	289521	292074	289.521	175	3	604.446655	10.36194266
Liechtenstein	33694	34079	34447	34.079	23	2.3	674.9024326	67.49024326
Norway	4538159	4564855	4591910	4564.855	1851	86	405.489331	18.83959074
Switzerland	7284753	7339001	7389625	7339.001	3800	583	517.7816436	79.43860479

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Last update: Thu Jan 26 22:29:51 MET 2006