Using a Dashboard-based Statistical Information System to Support Online Learning - The Tourism Monitor Project

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Abstract: The Tourism Monitor project is concerned with the development and deployment of statistical models of information relating to tourism within Norway, particularly within Buskerud and Nordland counties. An online dashboard system, offering intensively graphical information tools and widgets, has been developed as the core of the system, and this is currently being trialled with end users. However, the majority of staff working in tourist-based activities are unskilled in the use of statistical information, and as a result may not be able to benefit themselves or their organisations from use of the system. Rather than see this as a problem, the project partners have seen this as an opportunity to design a system that is both easy to use for inexperienced users, and provides a range of online learning opportunities and materials to enable staff working in the tourism industry to use the dashboard as an online learning environment.

1. Introduction

There has been a considerable body of research and development in recent years considering the visualisation of data from large datasets as a means of improving both understanding and usability of that data. The argument is that, once users understand the context in which the data is presented, the visual presentation immediately highlights areas of interest or concern and gives the users a far clearer picture of the situation quickly and easily. Of course, the reality is that this only happens if the visualisation is well designed and tuned appropriately to the context and the needs of the users. In fact, as we know from the world of art, the relationship between an image produced by an artist and the interpretation of that image by a viewer can be quite disparate. Accordingly, in the development of data visualisation there is a need to ensure both a high quality of design and effective preparation of end users of that visualisation, both in contextual information and in training, where required (Ware, 2013).

Dashboards are a particularly popular form of data visualisation application, being seen more and more as a business development tool helping business managers plan and monitor performance quickly and easily (Eckerson, 2011). Dashboards have quickly gained currency in a number of application areas, where the need for speed of information is often coupled with the desire to simplify the presentation of the data, or indeed a limited knowledge of the underlying data on the part of the users. This is particularly true in domains such as tourism, where those involved in running the wide range of businesses involved in the tourist industry may have limited knowledge and understanding of the underpinning statistical data models that characterise their industry, but are nonetheless keen to use the information generated from those models to plan and run their business operations. In particular the balanced scorecard model of dashboard information system has been particularly popular in this domain (Kaplan & Norton, 1996) (McPhail et al, 2008).

Betts and Edgell (2013) report that the World Travel and Tourism Council projects that "the travel and tourism industry will increase to 10 percent of global Gross Domestic Product (GDP), approximately US$10 trillion, and account for 328 million jobs – 1 in every 10 jobs worldwide" and they argue ten strategies to meet workforce needs, in particular in education. Paramount within these, the significant need is to provide effective and high quality education and training materials in the workplace, and link these to further and higher education qualifications, to allow management and staff to progress and develop while undertaking their normal roles, achieving one of the major goals of lifelong learning.

The key concept in the design of the Tourism Monitor system is in the visualisation of complex data sets to provide more readily accessible and usable constructs. The dashboard system consists of an underlying transactional database and historical data warehouse structure, developed centrally from nationally collated statistical datasets on three key criteria: guest, business, and destination indicators. The data is queried and filtered through a production rules engine, offering comparative and combinatorial functions based on simple mathematical and comparison operators. The resultant outcomes are then pushed into a user-configurable, responsive design, display interface,

offered as a web service so they can be viewed without specific browser or other software requirements on user devices. Standard online help facilities provide users with information on the functionality of the interface, and help to troubleshoot problems with the system, but these are extended by context-specific learning support materials to enable users to understand the information presented in the dashboard and learn how to use it within their sector of operation. Users access the system through a standard userid-password combination, which enables their sector of operation (e.g. accommodation, restaurant services, transport, entertainment venue, etc.) to be identified and the system configured to provide context-specific help and learning material to be provided on request.

A fully functional prototype of the system has been developed and deployed for user trials at selected sites in the Buskerud county and Nordland county, with evaluation focusing on the usability of the system, configurability of the information, and learning support for tourism staff. Also, within the project, a new set of training materials, utilising eLearning, face-to-face meetings and practical on-site training, has been developed to support both management and front of house staff in the tourism industry. The next stage of development, and the real novelty of the Tourism Monitor system, will be to directly link the dashboard system to the eLearning materials, to support on-site context-specific learning, lifelong learning, and to address the knowledge and skills gaps in the tourism industry, encouraging many more staff to undertake formal qualifications.

2. The Tourist Monitor Project

The Buskerud County lies to the west of Oslofjord in Norway, and is, especially in the northern part of the county, a rural region, with a high incidence of second home tourism and tourism in general in mountain regions (Velvin et al, 2013). Outdoor tourism activities such as skiing and hiking are popular in both the summer and winter tourist seasons. The Nordland County lies in the northern part of the Norway, the most famous tourism area is Lofoten, with spectacular scenic views and cultural landscape, and with authentic fishing towns where they still put the stockfish up on the drying rack, or flake (in Norwegian, "hjell"). The midnight sun in the summer and Northern lights in the winter, together with the authentic scenery, make this a popular tourism area. Both regions attract a significant number of overseas visitors, and offer transport links to the major Norwegian cities, the international airports, and the road and rail networks through Scandinavia.

The Center of Tourism Management at the Buskerud & Vestfold University College was successful in attracting Norwegian government research funding to develop online tourism support services for the Buskerud county & Nordland county, as part of a project to support innovation research in tourism in the region (Hjalager 2002 & 2010). The Center is seeking to integrate centrally collated statistical information into the planning and development processes for tourism in the regions, both in terms of the provision of public services and the commercial planning of individual businesses.

Under the leadership of Dr. Velvin, the project has established a partnership with a number of local tourist industry organisations, both public sector and commercial, to work together on establishing innovative research in tourism in the regions, and to commission and evaluate software tools to support that research. The project partners are also considering the training and education needs for staff in the industry, within the regions, and relating these to the formal qualifications provided by the College. As part of this consideration, the achievement of qualification by credit accumulation, a key tenet of the lifelong learning model, is under discussion.

3. The Tourist Monitor Dashboard Application

As a core component of the Tourism Monitor project, the project leadership sought to develop a dashboard application, offering flexible and dynamic information comparison and a balanced scorecard model to provide businesses with the information and knowledge on existing tourism statistics and trends, covering business, guest and destination indicators, to inform their planning (Malhotra, 2005).

Through an existing research partnership established at Buskerud & Vestfold University College, the job of developing the Tourism Monitor Dashboard application was awarded to a software development team at the University of Greenwich in London, under the leadership of Professors MacKinnon and Bacon. User requirements capture, the interface to the partnership user community for testing and feedback, and project leadership were provided by Doctors Velvin and Graven.

As is common in the majority of such applications the focus has been to provide an intensely graphical application, with limited text and reasonably intuitive and/or familiar interface components to enable users to quickly get to grips with navigation and information generation within the tool. The underpinning datasets used to populate the dashboard are generated from Norwegian government tourism statistics (SSB), collated centrally and circulated quarterly to regional centres, as indicated above they focus on three types of indicator – business, guest and destination. These are uploaded into a transactional database, which supports a production rules engine that can generate interface widgets displaying mathematical, logical and/or combinatorial relationships between attributes in the statistical data, e.g. simple statistical comparisons between visitors from different countries in terms of length of stay and type of accommodation. Whilst the transactional database provides access to the current or most recent dataset, a historical data warehouse also sits at the back of the system and can be interrogated to determine trend data over time, e.g. the change over a number of years in the number of visitors from certain countries and the type of accommodation they seek. Clearly such information can be used both to plan the services currently on offer to tourists and also to strategically develop new businesses and services reflecting the trend data determined from the historical data. The project plans to further develop the range and value of the data in the system by capturing data direct from tourism businesses in the region, as well as the centrally collected and collated data, and by developing online guest surveys to capture data direct from tourists. In Figure 1 you can see the administrator interface, separated into the three types of indicator, and offering data upload to populate the database, and rule-based services to populate the user maps and widgets.
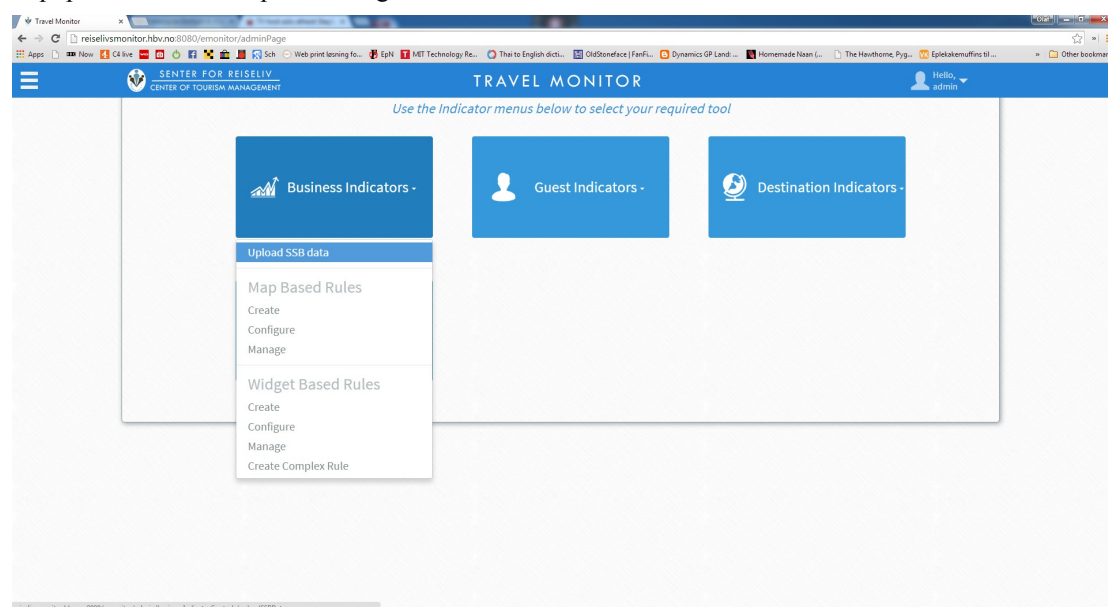

Figure 1: Administrator interface to upload SSB statistical data

With the underlying data structures, and upload and capture facilities, in place, the system then has to provide an appropriate interface to display the outputs of queries and rule-based constructs generated from that data. Fundamentally, the system offers two types of interface, map-based and widget-based. Map-based interfaces provide relative geographical data, at the level of granularity chosen by the user, against the three types of indicator. Users can drill down or up using simple mouse clicks on the maps, or they can navigate using menu systems if they prefer, particularly useful if they are unfamiliar with the map layout. Figure 2 shows the map layout for the whole country of Norway, while Figure 3 shows the drill down to Buskerud County, and Figure 4 shows the menu-driven drill down to Buskerud.

Key features of the interface are:

- Fully user-configurable, so the layout, colours and data represented can be fully determined by the users

- Designed responsively, so the interface can be viewed on any device and will configure dynamically to achieve the best representation on that device

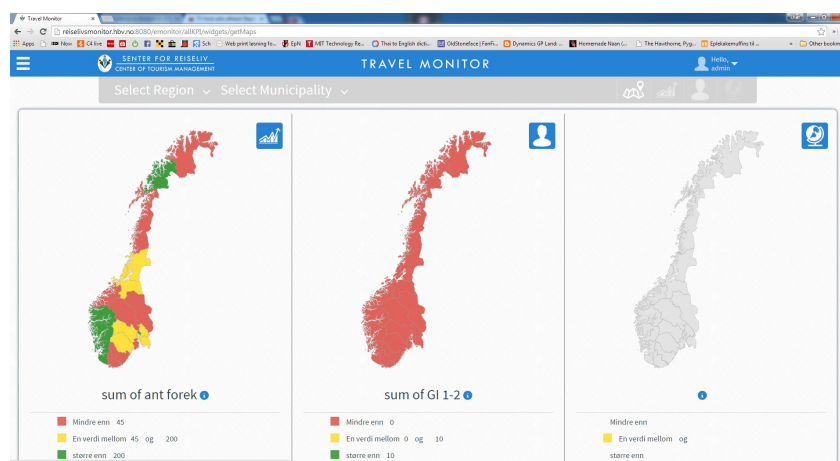- Offered as a web service, so requires no specialist software and can be viewed on any web browser

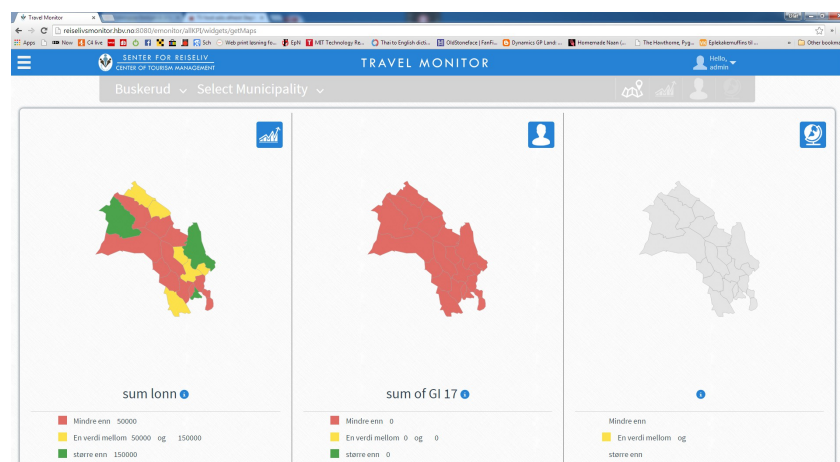**Figure 2:** Dashboard Start Page - Business map + guest indicator map + destination map

Figure 3: Drill-down selection of region in maps – Buskerud region selected
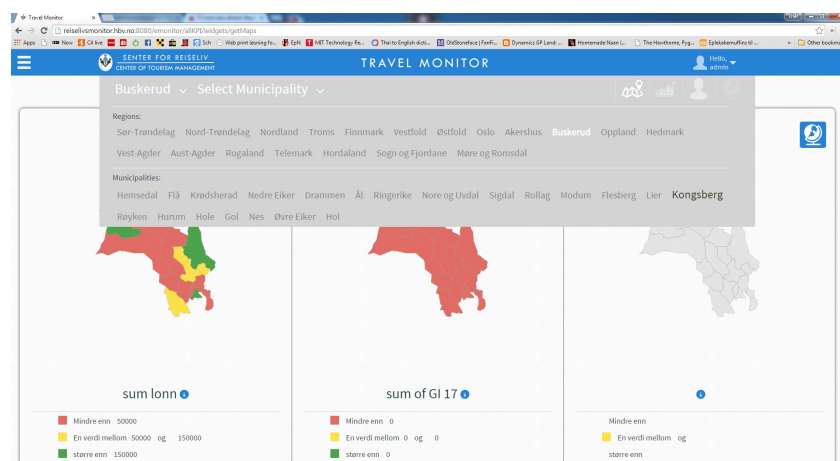

Figure 4: Menu selection as opposed to map selection

In contrast to the map-based interfaces, widget-based interfaces are generated through the production rules engine, and therefore represent specific data relationships that the user, or system administrator, wishes to investigate, or use to categorise a particular relationship or business element. Widgets are also subject to responsive design, to ensure that they can be viewed and sized appropriately to different devices, although layouts may vary between devices to achieve optimal configurations. To avoid unnecessary clutter on the screen, the administrator can set a threshold limit for the number of widgets that can be supported, and by default this is 9, reflecting the "7+/-2" rule from HCI research (Miller, 1994) to avoid information overload. Figure 5 shows the rule creation tool, which informs the production rules engine which data to select from the database, how to combine the data formulaically, and then presents the outcomes in an interface widget. Figure 6 shows the outcomes of this process in the widget-based description of the city of Kongsberg in Buskerud, or at least those elements of data about the city that the user thought to be relevant to display.

Figure 5: Rule creation tool – generating widgets for Business Indicators
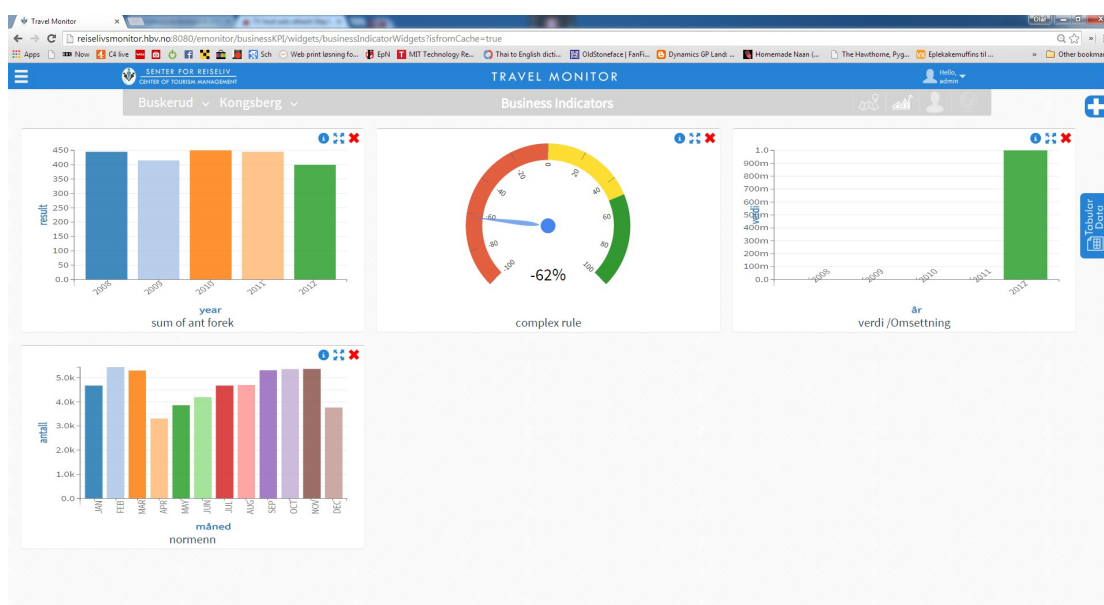
Figure 6: Widget-based view of city of Kongsberg, based on Business Indicator rules

In both styles of interface, data can be thresholded for comparative purposes between different areas within the region or on a time series basis in individual areas and/or domains, to support balanced scorecard representation. This permits services or businesses to quickly highlight areas of change, where action may be required.

The initial prototype of the Tourism Monitor application, which has been developed and is currently deployed for user trials, provides all the functionality described above. Further development of the system, including tools to capture data into the system direct from user sites, the extension of the rules engine to offer more complex rule constructs, and external linking to commercial tourism information sources, will follow. However, this further development will be driven by further user requirements and feedback identified from the user trials.

4. **Developing the Dashboard as an Online Learning Environment**

As a normal component of the development of the system, the Tourist Monitor application is fully documented, and that documentation is provided within the system as online help facilities to support users and administrators in their use of the system. The documentation model is informed by the minimal manual model proposed by Carroll (1990). The online help is obviously context specific in that the user selection of help relative to a particular component of the system will result in help information relative to that component, however the goal of the system is to provide far more focused context specific help. In fact, one of the goals of the project that has emerged from the work done to date is to develop the dashboard as an online learning environment, offering context sensitive help relative to the role and domain of the user, which then links to online learning materials developed and provided by the project partners and the College, in turn linking to academic credit-bearing learning outcomes that could lead to qualifications by credit accumulation. This would allow tourism and public service staff at all levels to become more knowledgeable about the use of statistical information and trend analysis to support their business plans and activities, and then develop further to gain greater knowledge about their domain and tourism and eventually achieve formal qualifications, addressing the need identified by Betts & Edgell (2013).

Using eLearning combined with meetings and practical training has been the focus of this project in Hemsedal, a municipality in Buskerud county. This destination is a part of the pilot study of the mountain region for the Tourism Monitor project, with a focus on how to implement statistical information to create value at the destination level. Hemsedal is a ski tourism destination, with around 50% of tourists being international, and there is a turnover among tourism employees of about 40 %, with the average age of the those employees interacting directly with the tourists being 22 years. The background for the pilot study was that the guest survey showed a high variation between the different businesses at the destination in customer satisfaction feedback (Engeset & Velvin in Press). To reduce the fluctuation in customer satisfaction there has been a focus on training the management and the front of house personnel in the different businesses at the destination. Management staff in the different tourism businesses have begun to be trained in both theoretical and practical management, such as how to handle conflicts, perception, leadership, service excellence, etc. However, using statistical information similar to that presented in the Tourism Monitor dashboard, we still see low levels of understanding for what the different "statistical numbers" actually represent. This lack of understanding has been important in the further development of the training program, to link both the theoretical and practical understanding of the statistical information – showing how to make strategies based on that information.

Being aware of the lack of theoretical understanding of the practical work has also been a very important factor in developing the training program for the employees of the different tourism businesses at the destination. The employees will be trained for the next winter season in skills to improve guest satisfaction, such as hosting the guest, communication, self-awareness, cross cultural awareness etc.

Both programs have the goal to improve the service level at the destination, with top-down and bottom-up approaches in each of the businesses. Figure 7 shows the link between the systematic customer feedback and the training components. The model also shows how the work in the pilot study at the destination is organized and what

to expect from the output if the training and learning process is organised to maximize the customer satisfaction and employee satisfaction.
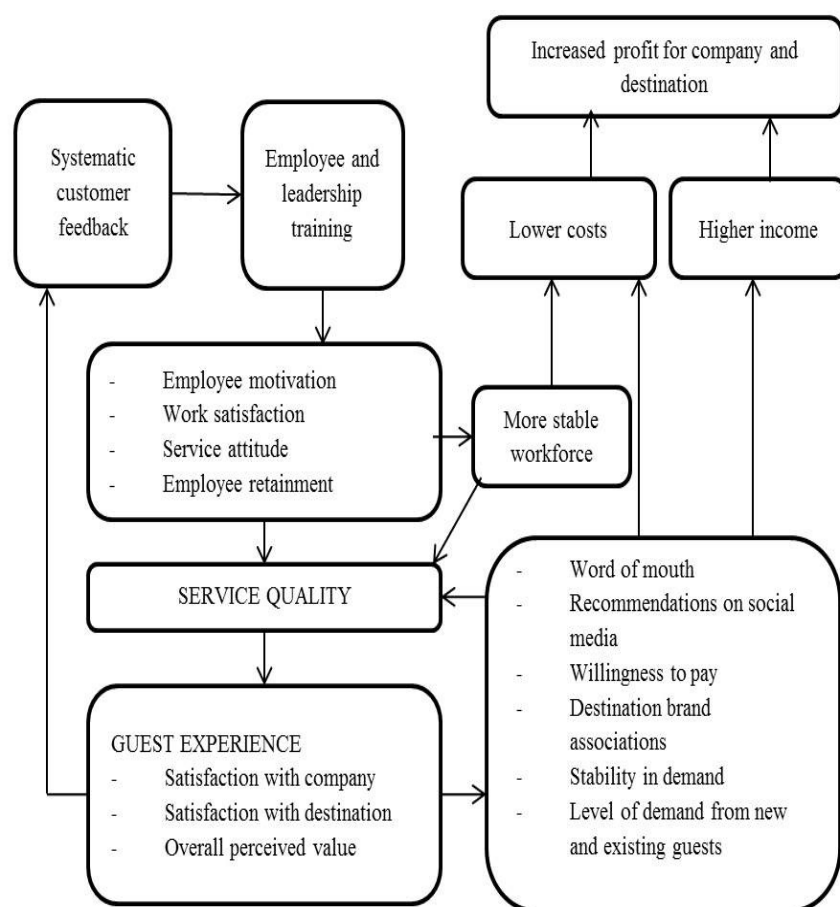

Figure 7: The Service Quality Excellence Model (Engeset & Velvin in Press)

To deliver good training it was important to make a training program with components of eLearning, meetings and practical skills training for both managers and their employees. The managers are enhancing their management skills and it is therefore expected that employee satisfaction will increase. The front of house staff will, through their training, develop better skills in handling guest expectations. An overall picture of the training program components to be run at Hemsedal is shown in figure 8. It is important to notice that figure 8 only shows the training taking place face-to-face or online in Hemsedal, and not the component where the employees or the managers could take credits at the College, which will be the next phase of the development of the programme. In this next phase, the dashboard system will also be extended to offer a direct learning interface, and access to individual learning records. Obviously, this development is of particular interest to the College, since it offers a route to provide lifelong learning support to a large sector of the industry and links in to the formal qualification system they provide. Work in this area has already been undertaken in agriculture in New Zealand (Moller et al, 2012) and in tourism in Sweden (Fuchs et al, 2015), but the approach taken in this project is novel, focusing, as it does, on the extension of the use of the dashboard as an online learning environment. Whilst the development of the dashboard and the development of the learning materials have been undertaken separately, the common theme of the statistical information presented in the dashboard, and taught to tourism managers and staff through the learning materials, will enable the direct integration of the two. As a result, the online learning environment thus created will be able to support on-site

context-specific learning, lifelong learning, and to help address the knowledge and skills gaps in the tourism industry, encouraging many more staff to undertake formal qualifications.
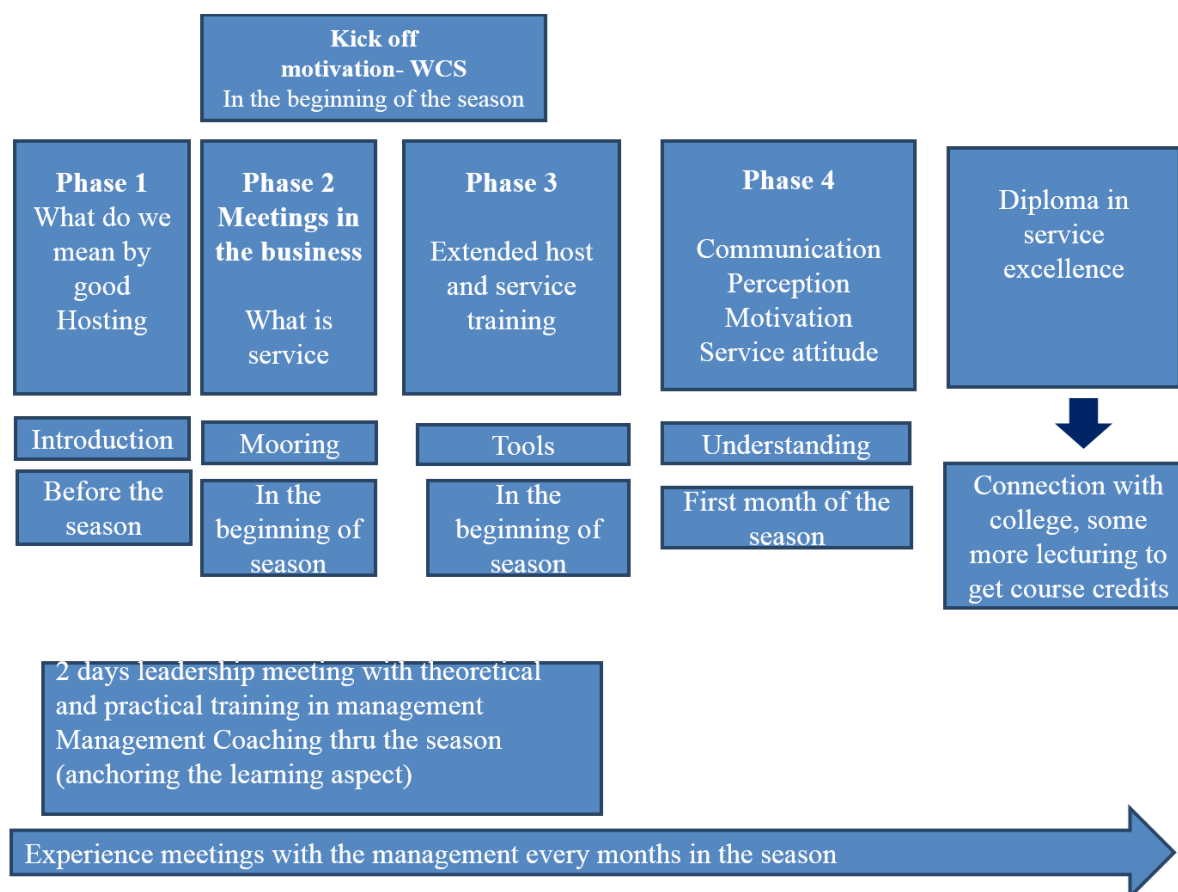

Figure 8: Training program for Hemsedal destination

In phase 1 we have an eLearning component for new employees, which they could take before they start work at the destination for the season. The program will be updated before every season, and this part provides basic information about the destination and how to handle requests from tourists. It also focuses on the values that have to be implemented to deliver a "World Class Service". The values are described as "*EPOK (in Norwegian) Engagement, Positivity, Attention, Competence*" and form the focus for the learning material. This phase includes information, reflection, and small test questions to focus on the learning aspect.

Phase 2 aims to get staff in the individual businesses to share the destination values, and to make the staff reflect on how to support fellow staff members and themselves in achieving outstanding work. The content in this phase is delivered through group lessons focusing on service delivery and asking the group to reflect on what service means to them. Additionally, how they could support each other in achieving excellent service delivery for both internal and external customers. During this phase it is important to work with just one type of business or department at a time and mix people from different organisations. The reason for keeping the group homogeneous is that the anchoring of the service concept, and the meaning of service, is different in different types of businesses at the destination.

Phase 3 has a focus on providing staff with practical tools to do their service work, in order to deliver an excellent service. This phase utilises eLearning, reflection and meetings with staff from different businesses at the destination, covering topics such as: What is good hosting, perception of the guest, and communication with the guest. Giving them concrete practical training in behaviour with a focus on the values espoused in "EPOK"

Phase 4 is a more theoretical part to provide staff with the underpinning for the practical implementation of service work. This phase has a direct connection to the College, combined with some additional lecturing to that commonly provided in such training. So, those of the staff that want to go further with, for example, a College diploma, can start their formal College education online at the destination. For these young staff, as most of them have come directly from high school, this will provide an opportunity to work and study at the same time. For the destination the advantage/opportunity is to achieve lower staff turnover, resulting in a reduction in the cost of training new recruits, and the most valuable result of more highly trained staff, which will generate higher customer value (Engeset &Velvin in Press). This reduced turnover and increased competence level will also increase customer satisfaction.

To support knowledge accumulation for the individuals, the businesses and the destination, users are identified through the normal userid and password authentication mechanism, and a user profile, developed during the registration process and then extended through usage, is invoked. This will enable the system to provide context sensitive help as required, relative to that user's role and domain of work, as well as to the component of the system they are using. From there the user will be able to access online learning materials, specifically relevant to their learning requirements, and their individual learning record.

5. **Current Status and Future Work**

As identified earlier, the Tourism Monitor application is currently undergoing user trials by the project partners, in terms of usability, relevance, robustness and learning support. To date, there is no final data from these trials, although we expect to be able to present preliminary findings at the conference. However, the initial indications from the feedback provided during configuration and bug fix are extremely positive. Users are indicating that they find the application easy to use, the graphical interface is appealing and understandable, and the help facilities useful and supportive in learning to work with the system. For the moment rule configuration and introduction is restricted to the administrators, so although we have positive feedback on this, it is limited. Currently, the learning materials are limited to the context-sensitive help on the system itself, with some explanation of the indicators, what they mean and how they can be used, but we do hope to obtain feedback from users if they find this a useful vehicle for the delivery of wider ranging learning materials, as we plan. The learning materials are also under development, have been trialled in Hemsedal, and, as indicated earlier, have highlighted the existing lack of understanding of what these "statistical numbers" actually represent.

This combination of the identified need for training and development, the visually accessible presentation of information in the dashboard, and our clear plan to integrate the learning materials into the Tourism Monitor system to create an online learning environment, offers a unique and compelling opportunity to improve both tourism workforce development and tourism customer services in Norway.

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